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UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

LIST OF UNIDO PUBLICATIONS ON FERTILIZERS *

1967** - 1983

Prepared by the

Chemical Industries Branch
Division of Industrial Operations

* This document has been reproduced without formal editing.

** A few of the documents in this list were prepared in the period prior to the inception of UNIDO and have been distributed under a symbol of the Center for Industrial Development or other non-UNIDO symbol.

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CONTENTS

		Pages
I.	Major Studies and Reports	1 - 10
II.	Recurrent Publications and Series	11 - 13
III.	Documents/Reports on Expert Working Groups, Workshops, Seminars and other Meetings	14 - 98

Documents are in general available from the Documents Unit (Publications Section) of UNIDO, except if otherwise indicated. If a document should be out of stock, a reference copy is available for consultation or copying at the Vienna International Center Library or at the Reference and Terminology Unit (Translation Section) of UNIDO.

Working Group documents, ID/WG. ..., are available from the Documents Unit of UNIDO only for approximately two years after their issuance. At present documents in the series ID/WG. 1 - 340 are no longer in print, except if issued also under the symbol ID/... which are always on stock. However, also in these cases reference copies in document form or on microfiche are available for consultation or copying at the VIC Library and/or Reference and Terminology Unit of UNIDO. Microfiche may also be ordered from the UN Sales Section, Room A-3315, New York, N.Y. 10017 or Palais des Nations, Geneva, Switzerland, at a price of $ US 1.65 per fiche. (Orders from official and government bodies benefit from a 25% discount.) The document symbol number must be quoted!

I. Major Studies and Reports

		Language
ST/ECA/75 (63.II.B.3)	Cement. Nitrogenous Fertilizers Based on Natural Gas. (Studies in Economics of Industry, No. 1) */ New York, 1963. 39 p. Tables, Graphs, Diagram. CID publication giving pre-investment data for the cement industry and for the fertilizer industry based on natural gas - Covers (1) Capital investment and manpower needs, labour productivity, production costs, trends in production, consumption and trade for both industries (2) Choice of technology (3) Nitrogenous fertilizer by-products of natural gas, i.e. ammonia, ammonium nitrate, urea and ammonium sulphate. Statistics, Flow Chart.	E F S
CID/IPE/D.35	A Study of the Feasibility of a Fixed-Nitrogen Facility in the Philippines **/ By Arthur D. Little, Inc., USA Inter-Regional Symposium on Industrial Project Evaluation, Prague, 1965 New York, 1965. 31 p. Tables CID publication on industrial project evaluation, with special reference to establishing a nitrogen fertilizer industry in the Philippines - Covers (1) Market information (world market, USA, Europe, Far East, India, domestic market) (2) Economic aspects of proposed operation; choice of technology for ammonia and urea processes; capital investment, raw materials, production costs, investment returns, prices, etc. Recommendations, Statistics.	E
E/CN.14/AS/ II/2/C/1	Fertilizer Industry in the UAR. Symposium on ***/ Industrial Development in Africa, Cairo, 1966 New York, 1965. 8 p. CID publication. Government report on the fertilizer industry in Egypt - (1) Stresses the importance of high productivity in agriculture and consequently high consumption especially of nitrogen but also phosphorus fertilizers (2) Lists and describes existing and planned fertilizer plants.	E

*/ Reference copy in UNIDO Reference and Terminology Unit

**/ Microfiche in VIC Library

***/ Reference copy in VIC Library

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		Language
CID/4	Creating, Evaluating and Establishing Successful Chemical Fertilizer Projects */ By C. J. Pratt New York, 1966. 74 p. CID publication on fertilizer industry projects and project evaluation in developing countries - Covers (1) Development planning and the impact of individual projects on the national economies (2) Guidelines for project evaluation considering market information, availability of raw materials and manpower, location of industry, capital investment, etc. Annexes basic information required for fertilizer project studies. Bibliography.	E
CID/IPE/TW.4	An Economic Evaluation of the Durgapur Fertilizer Project: A Case Study of Social Benefit-Cost Analysis from India. **/ By A.K. Sen and M. Datta-Chaudhary Training Workshops on Industrial Project Formulation and Evaluation, 1967 Vienna, 1967. 38 p. Tables Publication on project evaluation with regard to a fertilizer industry project in India - Presents a case study of social cost benefit analysis in West Bengal, covering: Project soundness, time factor, parameter values, project value; labour costs and price of investment; cost of capital; investment returns; social rate of discount and shadow prices of foreign exchange; re-investment of project benefits, etc. Statistics.	E
ST/CID/15 (67.II.B.1)	Fertilizer Manual **/ New York, 1967. 218 p. Tables, Graphs, Diagrams, Illus. Handbook on the Fertilizer Industry with particular reference to developing countries. Covers (1) Role of fertilizers in agriculture (2) Data on World Production, World consumption, demand, trade, prices (3) Criteria for domestic production versus imports of fertilizers and raw materials (4) Marketing, distribution, price policy (5) Location of industry, development planning, etc. Flow charts, Statistics, Bibliography, Illustrations.	E F S

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Language

ID/2 (68.II.B.1) — Fertilizer Production, Technology and Use — E F S

Papers presented to the United Nations Interregional Seminar on the Production of Fertilizers, Kiev, Ukr.SSR 24 August - 11 September 1965.
New York, 1968. 404 p. Tables, Graphs, Diagrams, Maps.

Contains reports and conference papers covering (1) World trade and production, including regional and country reports (Part one) (2) Technology (Part two)(3) Economic aspects, including planning, marketing and use in agriculture (Part three). Statistics, Diagrams, Flow charts, Maps.

ID/5 (69.II.B.5) — Fertilizer Production in Six Selected Countries with Good Natural Gas Resources — E F S

Ad hoc Expert Group on Fertilizer Production, New York, 1966
New York, 1969. 68 p. Tables, Maps.

Report on fertilizer industry in Iran, Kuwait, Libya, Nigeria, Saudi Arabia and Venezuela - Covers natural gas resources and prices, manpower, infrastructure, tax, capital and investment policies, current exploitations and development potential, markets, regional co-operation, and recommendations for UNIDO action. Statistics, List of Participants, Agenda, Questionnaire, List of Documents, Maps.

ID/13 (69.II.B.21) — Factors Inhibiting Indigenous Growth of the Fertilizer Industry in Developing Countries — E F S

Ad hoc Group of Experts from Fertilizer-deficit Countries, Vienna, 1968
New York, 1969. 120 p. Tables, Maps.

Report (1) Sums up discussions and recommendations concerning problems inhibiting the growth of fertilizer production in developing countries (capital, raw materials, training, marketing, planning, price policy, regional co-operation) (2) Presents conference papers submitted. Statistics, Maps, List of Participants, Agenda, List of Documents.

ID/39 (70.II.B.29) — The Manufacture of Cement and Sulphuric Acid from Calcium Sulphate, by W.L. Bedwell — E

New York, 1971. 86 p. Tables, Graphs, Diagrams

Covers technical aspects, specifications, capital costs, quality control and raw material requirements for the manufacture of sulphuric acid and Portland cement from mineral and by-product calcium sulphate. Contains chemical formulae and temperature charts, flow charts, diagrams, bibliography.

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Language

ID/40/6 (69.II.B.39, Vol. 6) — Industrialization of Developing Countries: Problems and Prospects. Fertilizer Industry (Monograph No. 6) — E F S R

International Symposium on Industrial Development, Athens, Greece, 1967
New York, 1969. 76 p. Tables

Covers (1) World trends and production targets for the developing countries (2) Role of government taxation, foreign investment, sales promotion and price policies (3) Technical aspects and economic aspects of nitrogen, potash and phosphate fertilizer production (4) Project selection, production capacity, regional co-operation, etc. (5) UN TA and bilateral technical assistance schemes. Statistics, List of Documents.

ID/44 Vol.I (70.II.B.28) — Directory of Fertilizer Production Facilities. Part I, Africa. — E

New York, 1970. 271 p. Tables, Graphs, Map

Contains data and statistics on (1) Regional consumption and production capacities, including nutrients, from 1960 to 1975 (2) Individual country reports, giving information also on agriculture, natural resources, manufacturing, etc. Maps, Diagrams, Bibliographies.

ID/76 (72.II.B.16) — World Sulphur Supply and Demand 1960 - 1980 — E

By M.N.J. Horseman
New York, 1973. 165 p. Tables

Covers (1) World production and world consumption, supply and demand of brimstone, pyrite, and of sulphur in other forms, with attention to prices trends, regional markets, transport economics (2) Liquid sulphur transportation, with attention to vessel loading, materials handling and storage facilities, capital costs and operating cost. Statistics, including projections to 1980.

ITD.272 — Directory of Fertilizer Production Facilities. Part II, Asia — E

Vienna, 1973. 109 p. Tables, Graphs

Directory on the Fertilizer industry in ECAFE countries. Contains (1) Information on production capacities, supply and demand, present and projected consumption and production trends, raw materials, production of nitrogen, phosphate, sulphur and potash (2) Specific data on Burma, Korea DPR, Indonesia, Kampuchea, Laos, Malaysia, Philippines, Korea Rep., Vietnam Rep., Thailand, Afghanistan, Bangladesh, India, Iran, Pakistan and Sri Lanka.
Statistics, Bibliography.

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Language

ITD. 279 — Directory of Fertilizer Production Facilities. Part III, ECE Countries — E

Vienna, 1973. 72 p. Tables

(1) Contains information (A) on present and projected fertilizer demand and production capacity, and on existing facilities and industrial projects (B) on availability and production of fertilizer raw materials and fuels (2) Gives specific data on Albania, Bulgaria, Cyprus, Czechoslovakia, Greece, Hungary, Malta, Poland, Romania, Spain, Turkey and Yugoslavia. Statistics, Bibliography.

IOD.23 — Directory of Fertilizer Production Facilities. Part IV, Latin America — E

Vienna, 1975. 164 p. Tables, Graphs

Directory of Fertilizer Industry Facilities in ECLA Region. - (1) Contains country data for Central America and South America (2) Covers (A) present and projected fertilizer demand and production (B) existing facilities (C) industrial projects in implementation or planning stage (D) raw materials and fuels (E) development of the respective national economies, agriculture and manufacturing sectors. Statistics, Bibliographies.

ICIS.22/Rev.1 */ — Draft World-Wide Study of the Fertilizer Industry: 1975 - 2000 — E

Published by UNIDO in co-operation with Davy Pacific Pty. Ltd., International Fertilizer Development Centre, Tennessee Valley Authority with contributions from R. Cook, M. Eid, R. Ewell, C. Middlebrooks, J. Robertson Vienna, 1976. 267 p. Tables, Graphs, Diagrams.

Covers (1) Fertilizer world consumption, analysing the situation in developing countries and developed countries, and giving projections to 2000 (2) Fertilizer production: capital costs and production costs (3) Raw Materials (ammonia feedstocks, phosphate rock, sulphur, potash, etc.) (4) International trade, location of industries, marketing and distribution (5) Relevant government policies, incentives subsidies (6) Manpower needs, training. Extensive Statistics.

ITD. 351 — Catalyst Manual. A User's Guide to Catalysts for the Petrochemical and Fertilizer Industries — E

In co-operation with Joint UNIDO-Romania Centre, Bucharest Vienna, 1976. 2 vol. (various pagings). Tables, Graphs

Covers (1) Heterogenous catalysts for (a) main industrial processes: ammonia production; petrochemical industry; production of acids (b) unit operations; alkylation, cracking, desulphurization, hydrogenation, oxidation, polymerization, petrol, reforming, etc. (2) Homogenous catalysis (3) Catalyst carriers (4) Catalyst supply, giving indexes of manufacturers. Annexes, statistics. Additional references: chemicals, chemical reactors, hydrocarbons.

*/ Published in final form as UNIDO/ICIS. 81 + Add. 1 (see below).

Language

EX. 20 — The Successful Construction and Operation of Fertilizer Plants — E
By B. Raistrick
Vienna, 1977. 26 p.

Publication on establishment of new industry, with special reference to contracts applicable to fertilizer industry - Covers (1) Current practice in contracting; model contract; sequence of steps; invitation to bid, specifications, tenders, consultant contracts (2) Protection of interests of buyer and supplier, guarantees, penalties, arbitration, dispute settlement, insurance, export credit insurance (3) Insurance coverage for consequential losses, loss minimization. Annexes sample bonds (tender, bid, performance).

ICIS.81 + Add.1 — Second World-Wide Study on the Fertilizer Industry: 1975 - 2000 — E
Vienna, 1978. 138 p. (Add.1 64 p.) Tables, Diagrams

Global study on the fertilizer industry - Covers: Food, agriculture, fertilizers; fertilizer industry: World production, world consumption, international trade and distribution, technology transfer; the medium term outlook to 1987, forecasting; long term outlook; establishment of new industry in developing countries: Technical aspects, choice of technology, research and development, training, economic aspects; social aspects, industrial policy, pollution control. Reference: Nitrogen, potash, phosphate. Statistics.

IOD. 220 — Identification of Facilities Needed to Expand Fertilizer Production and Supplies in 23 Least Developed Countries — E
By F.J.E. Dierendonck, K.R. Krishnaswami, M.C. Verghese
Vienna, 1978. 138 p. Tables

Summarizes a survey of facilities needed to expand fertilizer industry and supply in 23 least developed countries - Covers fertilizer domestic market, marketing, transport, distribution, raw materials, energy sources, bulk blending, investment requirements, etc., with reference to Afghanistan, Bangladesh, Nepal, Yemen PDR, Yemen, Benin, Burundi, Central African Rep., Chad, Ethiopia, Gambia, Guinea, Malawi, Mali, Niger, Rwanda, Somalia, Sudan, Tanzania and Upper Volta. Recommendations, Statistics.

ID/209 — Process Technologies for Phosphate Fertilizers — E F S
Development and Transfer of Technology Series, No. 8
By K.R. Krishnaswami
Vienna, 1978. 50 p. Diagrams

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Language

Publication on choice of technology for phosphate fertilizer production - Covers (1) Process technologies relating to sulphuric acid, phosphoric acid, superphosphoric acid, single and triple superphosphate (SSP, TSP) Monoammonium phosphate (MAP), diammonium phosphate (DAP), ammonium sulphate phosphate, ammonium nitrate (with potash), urea ammonium phosphate (UAP), nitrophosphates (2) Technical aspects, process assessment, licensing, costs of factory erection. Reference: INTIB, ammonia. Flow charts, Bibliography, List of firms.

ID/211 Process Technologies for Nitrogen Fertilizers — E F S
Development and Transfer of Technology Series, No. 9
By V.S. Pillai
Vienna, 1978. 67 p. Tables, Diagrams

Publication on choice of technology for nitrogen production - Covers (1) Various process technologies, with special attention to ammonia synthesis gas, ammonia, urea, ammonium sulphate, ammonium chloride, nitric acid, ammonium nitrate, ammonium sulphate nitrate, calcium ammonium nitrate, sodium nitrate, potassium nitrate, nitrogen solutions (2) Technical aspects of operations, advantages and disadvantages of process, process owners, licensing. Reference: INTIB. Flow charts, Bibliography, List of firms.

ID/250 Fertilizer Manual. Development and Transfer of Technology Series No. 13 — E
By T.P. Hignett, H.R. Tejeda, F.P. Achorn, R.C. Smith G. Hoffmeister, C.J. Pratt
Vienna, 1980. 353 p. Tables

Handbook on fertilizer industry - Covers (1) Major fertilizer processes, choice of technology, giving sample evaluations of economic aspects (2) History, global level outlook, role of fertilizers in agriculture; raw materials glossary (3) Production and transport of ammonia and nitrogen fertilizers (4) Phosphate rock, sulphuric acid, phosphoric acid, phosphate fertilizers, controlled-release; physical and chemical analysis (5) Planning; pollution control, economics, problems. Additional references: Nutrients, nitric acid, ammonium nitrates, urea, capital costs, financing, technology transfer. Statistics, Diagrams, Bibliographies.

IO. 410 Organic Wastes for Fuel and Fertilizer in Developing Countries — E
By L.F. Diaz, C.G. Golueke
Vienna, 1981. 276 p. Tables, Graphs, Flow Charts, Diagrams, Illustrations

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Language

Expert report on solid organic waste utilization for fuel and fertilizer in developing countries - Covers (1) Nature of solid waste; importance of a sound waste disposal programme; resource recycling aspects (2) Determining quantity and composition of waste output (3) Use of organic matter as a fertilizer (4) Composting (5) Hydrolysis and single cell protein ethanol production (6) Waste as an energy source: survey of methods (7) Biogasification (8) Thermal recovery of energy. Statistics, Bibliographies. Additional references: urban areas, biomass, public health service, environment, choice of technology, pyrolysis, marketing.

IS. 231 — Users' Guides to the International Patent Classification (IPC). I - Fertilizers — E F

Prepared in co-operation with WIPO
Vienna, 1981. 24 p. Tables, Diagrams

Publication facilitating access to patents information required for choice of technology in the fertilizer industry - (1) Covers (a) patent documents as a source of technological information (b) the international patent classification (IPC): layout and use of symbols; subgroups (c) retrieval of patent documentation using the IPC (2) Appends material including: contents of IPC section on chemistry and metallurgy; relevant UNIDO thesaurus terminology and IPC equivalents; samples of INPADOC terminology and IPC equivalents; samples of INPADOC patent classification service (PCS), etc. Additional references: industrial information, INTIB, WIPO.

PC. 25 + Corr. 1 */ — UNIDO Model Form of Turnkey Lump Sum Contract for the Construction of Fertilizer Plant — E

Vienna, 1981. 229 p. Tables, Diagrams.

UNIDO model form of a turnkey lumpsum contract concerning factory establishment for fertilizer industry - (1) Presents a contract (specific to an ammonia-urea complex) containing 40 articles (2) Provides technical annexures. Additional reference: technology transfer.

PC. 26 + Corr. 1 **/ — UNIDO Model Form of Cost Reimbursable Contract for the Construction of Fertilizer Plant — E

Vienna, 1981. 209 p.

UNIDO model form of a cost reimbursable contract concerning factory establishment for fertilizer industry - (1) Presents a contract (specific to an ammonia-urea complex) containing 40 articles (2) Provides technical annexures. Additional references: technology transfer, costs.

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*/ Published in final form as UNIDO/PC. 25/Rev. 1 + Corr. 1 (see below).

**/ Published in final form as UNIDO/PC. 26/Rev.1 + Corr. 1 (see below).

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		Language
PC. 40 */	Guidelines on the UNIDO Model Form of Turnkey Lump Sum Contract for the Construction of a Fertilizer Plant Vienna, 1982. 71 p. Guidelines on the UNIDO model form of a turnkey lump sum contract concerning factory establishment for fertilizer industry in developing countries - Gives information to purchasers including (1) General guidelines; main features and obligations of the parties under the contract (2) Guidelines to specific articles, explaining both the essential aspects of each article and the reasoning behind key clauses in the most important articles. Additional reference: technology transfer.	E
PC. 41 **/	Guidelines on the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant Vienna, 1982. 69 p. Guidelines on the UNIDO model form of a costs reimbursable contract concerning factory establishment for fertilizer industry in developing countries - Gives information to purchasers including (1) General guidelines; main features and obligations of the parties under the contract (2) Guidelines to specific articles, explaining both the essential aspects of each article and the reasoning behind key clauses in the most important articles. Additional reference: technology transfer.	E
PC. 25/Rev. 1 + Corr. 1	UNIDO Model Form of Turnkey Lump Sum Contract for the Construction of a Fertilizer Plant, Including Guidelines and Technical Annexures Vienna, 1983. 298 p. Tables, Diagrams. UNIDO model form of a turnkey lumpsum contract concerning factory establishment for fertilizer industry - (1) Presents a contract (specific to an ammonia-urea complex) containing 40 articles (2) Provides guidelines and technical annexures. Additional reference: technology transfer.	E
PC. 26/Rev.1 + Corr. 1	UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant, Including Guidelines and Technical Annexures Vienna, 1983. 276 p. UNIDO model form of a cost reimbursable contract concerning factory establishment for fertilizer industry - (1) Presents a contract (specific to an ammonia-urea complex) containing 40 articles (2) Provides guidelines and technical annexures. Additional references: technology transfer, costs.	E

*/ Published in final form in UNIDO/PC.25/Rev.1 (see below)
**/ Published in final form in UNIDO/PC.26/Rev.1 (see below) ./.

Language

PC. 73 + Corr. 1 — E

Second Draft of the UNIDO Model Form of Licensing and Engineering Services Agreement for the Construction of a Fertilizer Plant Including Guidelines and Technical Annexures

By A. Shah Nawaz

Vienna, 1983. 141 p.

Publication regarding contracts for licensing and engineering services for the construction of a fertilizer industry (reference: factory establishment) - Presents a UNIDO model form of such an agreement, containing (1) General and specific guidelines (2) The text of the agreement, consisting of eleven articles (3) Technical annexures. Additional reference: technology transfer.

PC. 74 + Corr. 1 — E

Second Draft of the UNIDO Model Form of Semi-Turnkey Contract for the Construction of a Fertilizer Plant Including Guidelines and Technical Annexures

By A. Shah Nawaz

Vienna, 1983. 291 p. Tables, Diagrams

Publication regarding semi-turnkey contracting for construction of a fertilizer industry (reference: factory establishment) - Presents a draft UNIDO model form of contract, consisting of forty articles; technical annexures. Additional reference: technology transfer.

II. Recurrent Publications and Series

		Language
ID/SER.A/14 (69.II.B.12)	Fertilizer Industry - Sectoral Study (In Industrialization and Productivity Bulletin No. 14, New York 1969. P. 75 - 103) Surveys the trends in world production and consumption, demand projections up to 1981, available production capacities, etc. for nitrogen, phosphate and potash fertilizers, and discusses the options open to the developing countries regarding the producing versus importing decision, and the choice of technology, as posed by capital requirements, economics of diverse processing methods, availability of raw materials, etc. Statistics, Flow Charts.	E F S

Fertilizer Industry Series

ID/SER.F/1 (68.II.B.17)	Chemical Fertilizer Projects: Their Creation, Evaluation and Establishment Monograph No. 1 New York, 1968. 52 p. Tables. Contains detailed information of the technical aspects and economic aspects involved in project selection, planning, project implementation and project evaluation with reference to the production of fertilizers based on chemicals in developing countries. Statistics, Bibliography.	E F S
ID/SER.F/2 (69.II.B.10)	Guide to Building an Ammonia Fertilizer Complex Monograph No. 2 New York, 1969. 24 p. Guidelines for the establishment of an ammonia fertilizer complex - Deals with (1) Project evaluation in terms of market information, site assessment, production capacity, investment and production costs, choice of technology based on available raw materials, etc. (2) Project implementation based on overall project specifications, including equipment, skilled workers, training and laboratory facilities, maintenance and repair, etc. Bibliography, Project design data form and raw material specifications.	E F S
ID/SER.F/3 (69.II.B.26)	The Reduction of Sulphur Needs in Fertilizer Manufacture Monograph No. 3 New York, 1969. 61 p. Tables, Graphs, Diagrams.	E F S

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Language

(1) Deals with the technical aspects involved in reducing the consumption of sulphur in fertilizer processing, giving examples; patterns of world sulphur prices and supply and demand (2) Lists recommendations on use of processes and products to offset world sulphur shortage. Statistics, Flow Charts, Bibliography.

ID/SER.F/4 (69.II.B.20) The Ammonium Chloride and Soda Ash Dual Manufacturing Process in Japan — E F S

Monograph No. 4
New York, 1969. 31 p. Tables, Diagrams, Graphs.

Covers technical aspects, including raw materials, fuel and equipment requirements for various processes, stressing the advantageous effects of the fertilizers on soil and crop yield. Statistics, Flow Charts, Bibliography.

ID/SER.F/5 (69.II.B.23) New Process for the Production of Phosphatic Fertilizers Using Hydrochloric Acid — E F S

Monograph No. 5
New York, 1969. 30 p. Tables, Diagrams, Graphs.

Covers (1) Technical aspects including raw materials, choice of product, etc. (2) Economic aspects including capital investment and production costs. Statistics, Flow Charts, Bibliography.

ID/SER.F/6 (71.II.B.9) Fertilizer Demand and Supply Projections to 1980 for South America, Mexico and Central America — E F S

Monograph No. 6
New York, 1971. 80 p. Tables.

Discusses the agriculture sectors of selected countries, based on general information, identified raw materials, farming patterns, land and economic policies, fertilizer consumption, with attention to imports, crop yields, etc. Bibliography, Statistics.

ID/SER.F/7 (74.II.B.5) Reducing Fertilizer Costs — E F S

Monograph No. 7
New York, 1974. 50 p. Graphs, Diagrams, Illustrations

Covers (1) Estimating nutrient demand, projection of consumption, determining types of fertilizers needed (2) Evaluating a country's resources, including existing production facilities, usable raw materials (nitrogen, phosphate, sulphuric acid, potash), port and transport facilities, etc. (3) Selecting a distribution system (4) Importing fertilizer (5) Keeping costs down, including economic aspects of blending and granulation. Statistics, Bibliography.

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Language

ID/SER.F/8 (76.II.B.2) — A Fertilizer Bulk Blending and Bagging Plant — E F S

Monograph No. 8
New York, 1976. 31 p. Tables, Diagrams.

(1) Describes a relatively uncomplicated factory which may be constructed in developing countries (2) Covers blending of fertilizer materials (3) Gives detailed description of plant and operations (4) Gives (A) Specifications for required equipment (B) Estimate of main capital costs involved. Factory layout, Statistics, Bibliography.

ID/SER.F/9 (77.II.B.2) — Guide to Pollution Control in Fertilizer Plants — E F S

Monograph No. 9
Vienna, 1977. 22 p. Table.

Covers (1) Gaseous effluents, air pollution (ammonia, nitrogen oxides, sulphur dioxide, gaseous fluorides, mist, fumes and dust) (2) Water pollution (nitrogen fertilizer and intermediates, phosphate fertilizers, boilers and cooling tower effluents) (3) Solid industrial wastes, i.a. gypsum (4) Potash (5) Trends and legislation in developed countries and developing countries; role of UNIDO (6) A "grass-roots" factory, specifications, environment surveys (7) Economic aspects. Bibliography.

UNIDO Guides to Information Sources

LIB/SER.D/21 (ID/164 and Corr.1) — Information Sources on the Fertilizer Industry, No. 21 — E (F/S/R introduction)

Vienna, 1976. 96 p.

Directory giving sources of industrial information regarding the fertilizer industry.

LIB/SER.D/33 (ID/228) — Information Sources on Bioconversion of Agricultural Wastes, No. 33 — E (F/S/R introduction)

Vienna, 1979. 84 p.

Directory to sources of industrial information on the bioconversion of agricultural wastes (reference: biogas, energy source, composting, fertilizer). Bibliography.

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III. Documents/Reports on Expert Working Groups, Workshops, Seminars and other Meetings

Language

Expert Group Meeting on Utilization of Excess Capacity for Export
Rio de Janeiro, Brazil, 3 - 12 March 1969

ID/WG.29/11 — The Special Nature of the Fertilizer Industry in Developing Countries — E
Vienna, 1969. 9 p.

Publication on the prevention of excess capacity in the fertilizer industry in developing countries, especially in Africa. Discusses preinvestment surveys, market development, location of industry, size of enterprise, and regional co-operation.

Investment Promotion Conference for Tunisian Industry
Tunis, Tunisia, 28 - 30 May 1969

ID/WG.35/14 — Tentative Data on Project to Produce 300,000 Metric Tons/Year of Sulphuric Acid on the Basis of Imported Pyrite — E F
Vienna, 1969. 3 p.

Publication on the production of sulphuric acid from pyrite in Tunisia. - Gives tentative project data only.

Expert Working Group Meeting on the Manufacture of Chemicals by Fermentation
Vienna, Austria, 1 - 5 December 1969

ID/WG. 50/2 + Summary — Metal Recovery from Low-Grade Ores, Sulphur Recovery from Gypsum. The Role of Thiobacillus Ferrooxidans in Mining of Copper and Uranium, and the Role of Bacteria in Sulphur Production — E
Vienna, 1969. 25 p. Diagrams, Graphs.

(1) Discusses the role of microorganisms in copper recovery by leaching process (2) Proposes the use of bacterial leaching for uranium production (3) Describes experiments for production of sulphur from domestic and industrial wastes by addition of gypsum. Includes Statistics and Bibliography.

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Language

Seminar on Operation, Maintenance, Design and Manufacturing of Chemical Plants and Equipment in Developing Countries, Koenigstein, FRG, 25-26 June 1970

ID/WG.60/3 + Summary — Problems and Progress of Instrumentation in Chemical Industries in Developing Countries — E / E F S
By S.D. Bhasin, Vienna, 1970. 10 p. Tables, Graphs.

Publication on instrumentation industry for the chemical industry (petrochemicals, fertilizer, synthetic fibres and plastics industries) in India. Deals with the manufacture of production control instruments, and outlines (1) The gap between demand and production capacity (2) Efforts undertaken to compensate import restrictions (3) Shortage of engineers and technicians, and training schemes to remedy it, etc. Statistics.

UNIDO Meeting on the Development of Fertilizer and Pesticide Industries in Latin America
Rio de Janeiro, Brazil, 15 - 19 September 1970

ID/WG.80/1 — Aide-Mémoire — E S
Vienna, 1970. 4 p.

Aide mémoire for a meeting on the development of pesticides and fertilizer industries in Latin America.

ID/WG.80/5 — Import of New Technology on the Development of the Fertilizer Industry in Latin America — E S
Vienna, 1970. 59 p. Tables, Graphs, Diagrams.

Deals with technical aspects and economic aspects, such as technology, economy of scale, planning, production costs, equipment, imports of intermediates, etc. in the production of nitrogen and phosphate fertilizers. Statistics, Bibliography.

ID/WG.80/6 — Preliminary Survey of the Fertilizer Situation in Selected Countries in Latin America - Availability of Raw Materials, Description of Production Facilities and Historical and Projected Supply and Demand — E
Vienna, 1970.

Surveys the situation of the fertilizer industry in Argentina, Brazil, Central America, Chile, Peru, Colombia, Mexico and Venezuela, with respect to raw materials, fuel, location of industry, choice of product, production capacity, feedstock, consumption, and projections. Statistics, Tables.

ID/WG.80/7 — Wet Process Phosphoric Acid as a Basic Fertilizer Ingredient in International Trade — E S
Vienna, 1970. 29 p. Tables, Graphs, Diagrams.

Describes processing of phosphate rock in sulphuric acid plants and gives capital costs, production costs, capital investment involved, storage, transport and unloading facilities, etc. Statistics, Flow Charts.

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		Language
ID/WG.30/9	Report and Proceedings Vienna, 1971. 212 p. Statistics, Graphs, Diagrams. Contains (1) Summary of proceedings and recommendations (2) Agenda and List of Participants (3) Technical papers presented to the meeting and summaries of country reports. Flow Charts. Second Interregional Fertilizer Symposium Kiev, USSR, 21 September - 1 October 1971 New Delhi, India, 2 - 13 October 1971	E
ID/WG.99/4/ Rev.1 + ID/WG.99/4 Summary	Review of World Production, Consumption and International Trade in Fertilizers with Projections to 1975 and 1980 Vienna, 1971. 71 p. Tables, Graphs. Discusses growth rates in developing countries and developed countries. Statistics.	E E F S R
ID/WG.99/5 + Summary	Estimation of Fertilizer Requirements in Developing Countries in 1975 and 1980 in Relation to Desirable Nutritional and Agricultural Development Goals By J.P. Hrabovsky Vienna, 1971. 16 p. Tables, Graph. Discusses the methodology of analyzing agricultural development needs in 64 developing countries studied under the indicative world plan of FAO. Statistics.	E E F S R
ID/WG.99/6/ Rev. 1	Financial Implications of Meeting the Future Fertilizer Needs of Developing Countries up to 1980 By E.H. Becker-Boost Vienna, 1972. 112 p. Diagrams, Tables, Graphs. (1) Presents world production and world consumption figures showing an upward trend, with country and regional breakdowns (2) Discusses problems of investment costs; and considers the nitrogenous, potash and phosphate sectors (3) Forecasts future import and foreign exchange requirements. Statistics.	E
ID/WG.99/7 + Summary	Recent Advances in Ammonia Production Technology By J.A. Finneran, L.J. Buividas, N. Walen Vienna, 1971. 12 p. Discusses advances in feedstock desulphurization, steam hydrocarbon reforming, carbon dioxide removal and ammonia synthesis.	E E F S R
ID/WG.99/8/ Rev. 1	Ammonia Production Based on Various Raw Materials By K.S. Viswanathan, S.K. Mukherjee Vienna, 1971. 24 p. Diagrams, Tables. Covers technical aspects and types of feedstocks (heavy stocks, natural gas, naphta, coal, etc.); comparison of feedstock requirements, utilities, investment and production of nitrogen (crude petroleum, coal, heavy stocks, etc.); foreign exchange requirements. Flow Charts, Statistics.	E

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		Language
ID/WG.99/9 + Summary	Technical and Economic Survey of Nitrogenous Fertilizer Production By N.A. Afanas'ev Vienna, 1971. 19 p. Tables Publication presenting a technical and economic survey of the nitrogenous fertilizer industry in the USSR. Covers trends and projections in production and supply and demand of fertilizers in relation to an increase in crop yields; production costs per unit of nitrogen and production capacity for different types of fertilizers; Statistics of comparative costs of nitrogen.	E E F S R
ID/WG.99/10 + Summary	Large-Capacity Plants for the Production of Granulated Ammonium Nitrate By A.T. Zotov Vienna, 1971. 20 p. Tables, Diagrams. Discusses (with the example of the USSR) technical aspects of equipment design and layout; specific features of the process and plant operation; quality of the finished products; consumption figures; economic aspects. Bibliography, Statistics, Flow Charts.	E E F S R
ID/WG.99/11/ Rev. 1 ID/WG.99/11 Summary	Technip Mavrovic Heat Recycle Urea Process By I. Mavrovic, M. Bergonzo Vienna, 1971. 19 p. Graphs, Diagram Gives a process description and outlines basic improvements achieved in comparison to the conventional urea synthesis process: (1) Reduction in capital costs (2) Reduction in power consumption by heat recovery (3) Simplification of process and equipment design increasing the reliability of the plant. Flow chart, Statistics.	E E F S R
ID/WG.99/12 + Summary	The Mitsui Toatsu Urea Process By M. Yakabe, T. Sato Vienna, 1971. 26 p. Tables, Diagrams. Discusses (1) Performance of plants with large production capacities (2) Special features and description of two total recycle processes (3) Consumption figures and easy operability (4) Advanced technology in large-scale plants with reference to pollution control and computerized production control. Statistics, Flow Charts.	E E F S R
ID/WG.99/13 + Summary	The Chemico Thermo Urea Process: A Future Forerunner By L.H. Cook Vienna, 1971. 36 p. Diagram. Gives a process description and outlines important characteristics with regard to power consumption and costs, production capacity, process commercialization, etc. Bibliography, Flow Chart.	E E F S R

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		Language
ID/WG.99/14 + Summary	The Montedison Urea Process for Large Capacity Plants By G. Nardin Vienna, 1971. 19 p. Tables, Diagram, Illustrations Discusses (1) This total recycle process emphasizing low power consumption (steam power) due to heat recovery (2) Alternates to the cycle (3) Industrial achievements (e.g. lower production costs and equipment costs). Statistics. Flow Chart.	E E F S R
ID/WG.99/15 + Summary	Large-Capacity Ammonia Synthesis Reactors and Plants: Construction of Models and Optimization By M.B. Aizenbud Vienna, 1971. 28 p. Graphs, Diagram Publication on optimization of large production capacity ammonia synthesis reactors and plants in the fertilizer industry with the help of mathematical models and electronic data processing. - Discusses models aimed at optimum operation and reliability together with a reduction of capital costs and production costs. Bibliography, Flow Chart, Statistics.	E E F S R
ID/WG.99/16 + Summary	Present State of the Technology for the Industrial Production of Phosphoric Acid By N.D. Talanov Vienna, 1971, 41 p. Graphs, Diagrams. Discusses (based on USSR experience) advantages and disadvantages of the wet process, furnace process, dihydrate process and hemihydrate process, referring to characteristics of raw materials, economic aspects, and ways of reducing production costs. Statistics, Flow Charts, Bibliography.	E E F S R
ID/WG.99/17 + Summary	Extraction and Refining of Potash Ores in the USSR By R.S. Permyakov Vienna, 1971. 12 p. Publication on mining and potash ore processing for the fertilizer industry in the USSR. - Outlines (1) Production of potassium fertilizers on the basis of large raw material reserves (2) Application of advanced technology in potassium extraction (including an improved method of beneficiation) and refining (flotation hot solution crystallization). Bibliography.	E E F S R
ID/WG.99/18 + Summary	Ammonium Sulphate in the Production of Nitrophosphate By F.E. Steenwinkel Vienna, 1971. 18 p. Tables, Graphs, Diagram. Publication on ammonium sulphate as an intermediate in the production of nitrophosphate for the fertilizer industry. - Describes the Stamicarbon process for the production of compounds with high water soluble phosphorus pentoxide content and discusses the economic aspects. Bibliography, Flow Chart, Statistics .	E E F S R

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		Language
ID/WG.99/19 + Summary	Norsk Hydro Nitrophosphate Process By S.G. Terjesen, J.F. Steen Vienna, 1971. 16 p. Diagram. Describes the process and discusses licensing it on the world market; raw material flexibility; quality and grade flexibility of the products; economic aspects. Bibliography, Flow Chart.	E E F S R
ID/WG.99/20 + Summary	Typpi Oy's Solvent Extraction Process for Producing Compound Fertilizers By N. Lounamaa, L. Niinimaki Vienna, 1971. 12 p. Diagrams. Describes (1) Basic features of solvent extraction in general (2) Important characteristics of the Typpi Oy process referring to product quality, raw materials, capital costs, etc. Statistics.	E E F S R
ID/WG.99/21/ Rev. 1 ID/WG.99/21 Summary	Ammonia Production on the Basis of Coal and Lignite - Technical and Economic Aspects By E. Goeke Vienna, 1971. 29 p. Tables, Diagrams, Illustrations Covers various coal gasification processes; a detailed description of an industrial enterprise using brown coal as feedstock; a comparison of production costs based on various feedstocks (lignite, coal, fuel oil, and naphta); foreign exchange requirements. Bibliography, Flow Charts.	E E F S R
ID/WG.99/22 + Summary	Nitrophosphate Process Using Direct Cooled Continuous Crystallization - Chemoprojekt-BAMAG Process By J. Kotisek, L. Hellmer, H.P. Bethke Vienna, 1971. 38 p. Diagrams, Tables, Graphs. Discusses history, production, use, and distribution patterns of liquid mixed fertilizers in the USA and Europe; production, quality, and prices of phosphoric acids and base solutions with references to sequestration, hydrolysis, purification, solubility, etc.; agronomic considerations. Bibliography, Statistics.	E E F S R
ID/WG.99/23 + Summary	Comparative Production Cost of Fertilizers Made by Nitrophosphate Processes and by Conventional Sulphur-Based Processes Vienna, 1972. 13 p. Tables, Diagram, Graph. (1) Compares the calcium nitrate crystallization, ammonia sulphate and phosphoric acid extraction processes (2) Lists raw material and energy inputs and major equipment required. Flow Chart, Statistics.	E E F S R

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		Language
ID/WG.99/24 + Summary	New and Improved Fertilizer Materials Based on Urea By T.P. Hignett Vienna, 1971. 30 p. Table, Graphs, Diagram. Discusses (1) Improvement and physical properties of urea (2) Coating processes and conditioning of urea (3) Use of urea in compound fertilizers with special references to combinations with ammonium sulphate and ammonium phosphates. Bibliography, Statistics.	E E F S R
ID/WG.99/25 + Summary	Liquid Fertilizer Production and Distribution By T.P. Hignett Vienna, 1971. 35 p. Tables, Diagrams. Describes the direct cooled continuous crystallization process (CHP-SCHZ process) and the BAMAG Chemoprojekt nitrophosphate process with reference to technical aspects, investment, production costs, raw materials, product quality, power consumption, production capacity, etc. Statistics, Flow Charts.	E E F S R
ID/WG.99/26 + Summary	Development of New Catalysts for the Fixation of Nitrogen in the USSR By A.M. Alexeyev Vienna, 1971. 24 p. Tables, Graphs. (1) Discusses research results (2) Gives technical data of highly reactive and selective catalysts used for the production of ammonia, nitric acid, methyl alcohol, etc. Statistics.	E E F S R
ID/WG.99/27	Role of the Economic Commission for Asia and the Far East in Assisting the Countries in the Development of Fertilizer Industry Vienna, 1971. 7 p. Publication on the role of ECAFE in development aid for the fertilizer industry of developing countries - (1) Covers promotion of regional co-operation and joint ventures, organization of meetings, etc. (2) Refers to the activities of the Asian Development Council.	E
ID/WG.99/28 + Summary	Pollution Control in Acid Plants By J.M. Connor, G.J. Dell, D.J. Newman Vienna, 1971. 41 p. Diagrams. Publication on pollution control in plants producing sulphuric acid, phosphoric acid, and nitric acid for the fertilizer industry. - Describes the extent of the pollution problem and present and potential means of emission control. Flow Charts.	E E F S R

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		Language
ID/WG.99/29/ Rev. 1 ID/WG.99/29 Summary	Establishing a Domestic Fertilizer Industry Based on Imported Phosphoric Acid By T. Gans, D. Braude, Z. Itzkovitch, R. Brosh, P. Shapiro Vienna, 1971. 48 p. Tables, Graphs. Discusses (1) Basic concepts (relation between economy of scale, market, and infrastructure; fixed and variable costs components; variety of processing alternatives; imports of intermediates) (2) World consumption and world production patterns (3) Strategy of investment planning based on dynamics of market growth. Statistics.	E E F S R
ID/WG.99/30 + Summary	Use of Computers in Fertilizer Plant Design and in Operation of Fertilizer Plants By J. Saietz Vienna, 1971. 29 p. Publication on the use of electronic data processing in the fertilizer industry (for plant design, choice of technology, and process control). - Covers development and use of computer programmes; evaluation of catalyst performance; computer control of fertilizer plants and feasibility thereof; simulation and optimization of operation of chemical industries; future trends. Bibliography.	E E F S R
ID/WG.99/31 + Summary	Pruduction and Application of Fertilizers with Microelements in the Ukrainian SSR By P.A. Vlasyuk Vienna, 1971. 31 p. Discusses research on enrichment of superphosphate fertilizers with trace elements (manganese, zinc, molybdenum, lithium, boron, etc.) under different soil and climatic conditions. Bibliography.	E E F S R
ID/WG.99/32/ Rev. 1	Electrical Energy as Raw Material By M.T. Zaky Vienna, 1971. 10 p. Outlines the role of electricity as an energy source in electrochemical and electrothermal industries with reference to costs involved and the production of electrolytic hydrogen (for ammonia) and of elemental phosphorus.	E
ID/WG.99/33/ Rev. 1 ID/WG.99/33 Summary	Phosphate Rock: Trends in Supply and Demand in Relation to World Fertilizer Requirements By K.L.C. Windridge Vienna, 1971. 33 p. Tables, Graphs. Covers present world consumption and world supply and future world demand; technical aspects and economic aspects of phosphoric acid production and trade; freight rates (transport economics) and delivered costs of phosphate rock. Bibliography, Statistics.	E E F S R

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		Language
ID/WG.99/34/ Rev.1	Sulphur: Supply, Demand and Price Forecasts up to 1980 By J. Lastowiecki	E
ID/WG.99/34 Summary	Vienna, 1971. 48 p. Tables Covers world resources, world consumption, world production, trade, price trends of raw materials; economic aspects of sulphuric acid production, etc. Statistics.	E F S R
ID/WG.99/35/ Rev.1	Trends in Potash Supply By A. Von Peter	E
ID/WG.99/35 Summary	Vienna, 1971, 12 p. Tables Publication on trends in the supply and demand of potash. - Discusses projections of world production and world consumption; stock requirements and deposits. Statistics.	E F S R
ID/WG.99/36 + Summary	Scientific Prediction of Likely Areas for Agrochemical Ore Prospecting and Surveying By A.S. Sokolov Vienna, 1971. 24 p. Describes surveying operations in the USSR for apatites, phosphate rocks, potassium salts, and sulphur, with attention to the problems of developing countries.	E E F S R
ID/WG.99/37 + Summary	Production of Compound Fertilizers from Intermediates in Local Plants By R.D. Young Vienna, 1971. 49 p. Tables, Graphs, Diagrams, Illus. Discusses (with the example of the USA and other countries) role of large industrial enterprises; trade and transport of important intermediates and their use in granulation plants (with reference to equipment, technical aspects, pollution control, etc.); bulk blending; production of liquid mixed fertilizers; economic aspects. Bibliography, Statistics, Flow Charts.	E E F S R
ID/WG.99/38/ Rev.1	Role of UNIDO in the Development of the Fertilizer Industry Vienna, 1971. 8 p.	E
ID/WG.99/38 Summary + Corr.1	Describes UNIDO technical assistance activities and contains a list of operational industrial projects, a bibliography, and a list of meetings.	E F S R Corr. 1/E
ID/WG.99/39 + Summary	Monoammonium Phosphate as an Intermediate for Compound Fertilizer Production By I. Podilchuk, W.F. Sheldrick Vienna, 1971. 34 p. Tables, Diagrams. Discusses the Minifos Process and Plant; power supply, capital investment, and production costs; properties and advantages of Minifos. Statistics, Flow Chart, Bibliography.	E E F S R

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		Language
ID/WG.99/40/ Rev. 1	Financing New Fertilizer Plants - Experience of the World Bank Group	E
ID/WG.99/40 Summary	Vienna, 1971. 22 p.	E
	Discusses main problems encountered (by the World Bank Group) with regard to project selection, financing, project implementation, marketing, distribution, and government policies.	
ID/WG.99/41 + Summary	Experience in Planning the Fertilizer Industry in India By V.N. Kasturirangan, M. Satyapal Vienna, 1971. 24 p. Tables.	E E F S R
	Discusses pattern of fertilizer production; raw materials for production of nitrogen, phosphate, and potassium fertilizers; production statistics of nitrogen capacity based on different feedstocks.	
ID/WG.99/42 + Summary	Production of Fertilizers in the USSR By V.M. Borisov Vienna, 1971. 32 p. Tables, Graphs, Diagrams.	E E F S R
	Covers (1) Development of production of nitrogen, phosphate, and potash fertilizers and phosphoric acid (2) Establishment of large industrial enterprises applying advanced technologies (3) Complete utilization of raw materials. Statistics, Flow Charts, Bibliography.	
ID/WG.99/43 + Summary	Forecasting Production Costs for Fertilizer Processes By J.R. Potter Vienna, 1971. 35 p. Diagrams, Tables.	E E F S R
	Covers prospective and retrospective costs with special reference to developing countries; capital costs, treatment of cost of capital in production costs; overheads; review of estimating techniques. Statistics.	
ID/WG.99/44	The Preparation of the Technical Staff and Personnel for the Fertilizer Industry By M.T. Zaky Vienna, 1971. 8 p.	E
	Publication on training of technical personnel for the fertilizer industry in developing countries. - outlines training programmes developed in Egypt.	
ID/WG.99/45 + Summary	Training of Fertilizer Plant Personnel By P. Wuithier Vienna, 1971. 11 p.	E E F S R
	Covers (1) Development of a professional training project (2) Training programmes for technical personnel of various levels, and recruitment aspects (3) General organization aspects (selection, planning, financing) of the training project.	

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Language

ID/WG.99/46 + Summary
Fertilizer Marketing and Credit in Developing Countries — E
Vienna, 1971. 12 p. — E F S R

UNIDO/FAO publication on fertilizer marketing and agricultural credits for small farmers in developing countries. - Covers (1) Need for investments and strengthening of fertilizer marketing structures (2) Special problems related to agricultural development (e.g. evolution of distribution systems) (3) Support from governments and international technical assistance agencies.

ID/WG.99/47 + Summary
Marketing and Distribution Experience in India — E
By K.J.Pushpara — E F S R
Vienna, 1971. 14 p.

Discusses (1) Distribution network and marketing organization of FACT (Fertilizers and Chemicals Travancore Ltd.) and their sales promotion programme (2) Market development based on regular market research (3) Marketing costs and retail prices.

ID/WG.99/48 + Summary
Organizing the Supply of Fertilizers to Collective Farms and State Farms in the USSR — E
By I.F. Polyanskii — E F S R
Vienna, 1971. 24 p.

Covers requirements for transport and storage; balancing resources available with demands of national economy; planning of production and distribution, etc. Bibliography.

ID/WG.99/49 + Summary
Experience with Credit for Farmers in India — E
By D.C. Datey — E F S R
Vienna, 1971. 21 p. Tables.

Covers co-operative credit system for short term, medium term and long term credits; production oriented crop loan system for intensive agricultural programmes; credit stabilization funds; agricultural credits granted by state governments and commercial banks; role of Reserve Bank of India in credit support and promotions; credits for fertilizer distribution, etc. Statistics.

ID/WG.99/50 + Summary
Comprehensive Marketing: A Pre-requisite for Economic Fertilizer Production — E
By D.J. Halliday — E F S R
Vienna, 1971. 20 p.

Covers organizational aspects of fertilizer marketing at the farmer's level (local level), regional level, and national level, with references to infrastructure, financing, credits, educational aspects, demonstration, extension, prices, subsidies, and time factor.

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Language

ID/WG.99/51 + Summary
Transportation and Storage of Fertilizers — E
Vienna, 1971. 11 p. Tables — E F S R
Published jointly with Coromandel Fertilizers Ltd., Visakhapatnam, India

Covers various aspects of the fertilizer distribution system, such as transport by railways, road transport, inland water transport, coastal sea transport, and warehousing. Statistics.

ID/WG.99/52 + Summary
Projected Requirements for Fertilizers, Their Varieties and Means of Rationalizing Their Use, taking into account Climatic, Soil and Other Factors — E
By A.V. Sokolov — E F S R
Vienna, 1971. 32 p.

Covers (1) Varieties needed, and means of rationalizing their use, taking into account climatic, soil, and other factors (2) Problems applicable to conditions in the USSR based on agro-chemical studies and experiments. Bibliography.

ID/WG.99/53 + Summary
Fertilizer Control Laws and Regulations — E
By W.B. Andrews — E F S R
Vienna, 1971. 15 p.

Covers agronomic requirements; problems in high analysis granular fertilizers (including materials, changing grades, costs limit processing); bulk blended fertilizers; tolerances in chemical analyses; fertilizer inspection and quality control, recommendations.

ID/WG.99/54 + Summary
Use of Fertilizers in Developing Countries — E
Vienna, 1971. 20 p. — E F S R

Publication on use of fertilizers in developing countries as encountered in FAO development projects. Covers (1) Development and results of UN TA and UN Special Fund projects, freedom from hunger campaign, and fertilizer programme (2) Future requirements in research, training, extension work, development of distribution organizations, role of private enterprise and governments in promotion, role of development aid, etc.

ID/WG.99/55 + Summary
Economic Aspects of Fertilizer Use at the National and Farm Level in Developing Countries — E
By J.W. Couston — E F S R
Vienna, 1971. 25 p. Tables, Graphs.

Discusses (1) Role of fertilizers in economic development (2) Crop yield value index as indicator of productivity in agriculture (3) Economic measures (net return and value costs ratio) used by the FAO fertilizer programme (4) Economic optimum of fertilizer use (5) Price support and subsidies (6) Recommendations on strategies to stimulate fertilizer use. Statistics.

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Language

ID/WG.99/56 + Summary
Direct Application of Anhydrous Ammonia and Aqua Ammonia — E / E F S R
By W.B. Andrews
Vienna, 1971. 21 p. Tables, Graphs, Illustrations

Discusses (1) Properties of ammonia and the behaviour of nitrogen in the soil (2) Crop response (cotton, maize, oats, wheat, rice) (3) Ammonia in irrigation water (4) Equipment for applying ammonia. Bibliography, Statistics.

ID/WG.99/57 + Summary
Problems in Use of Nitrate Nitrogen in Paddy Rice Culture — E / E F S R
By T. Hayase
Vienna, 1971. 16 p. Map, Tables.

Publication on the use of nitrate nitrogen fertilizers in the cultivation of paddy rice in Japan. - Covers (1) Testing of compound fertilizers based on nitro phosphate for topdressing on experimental plots with varying soil, climate, and other environmental conditions (2) Evaluation of the results. Maps, Statistics.

ID/WG.99/58 + Summary
Under-Utilization of Potash in Agriculture in Developing Countries — E / E F S R
By G. Kemmler
Vienna, 1971. 30 p. Tables

Discusses (1) NPK (nitrogen, phosphorus, potassium) ratio in fertilizer consumption and increases in crop yields as a result of a higher potassium ratio (2) Nutrient uptake by cereals (3) Evaluation of soil testing data versus beneficial results of K application achieved in simple trials (4) Profitability and fertilizer extension. Recommendations, Statistics, Bibliography.

ID/WG.99/59 + Summary
Agronomic Results from Nitrophosphate Fertilizers in West Pakistan — E / E F S R
By A. Wahhab
Vienna, 1971. 26 p. Tables.

(1) Describes climatic and soil conditions and impact of fertilizers (particularly combined use of nitrogen and phosphorus) on crop yields of wheat and maize (2) Discusses production costs and agronomic feasibility (3) Includes recommendations on indigenous production of nitrophosphate. Statistics, Bibliography.

ID/WG.99/60 + Summary
Use of Fertilizers in Irrigated Agriculture in the USSR — E / E F S R
By I.N. Chumachenko
Vienna, 1971. 47 p. Tables.

Discusses (1) Long term application of nitrogenous and phosphate fertilizers to reach high crop yields of cotton, wheat, maize, rice, sugar beets, and vegetables (2) Co-ordination of irrigation programmes in arid zones and fertilizer use. Statistics, Bibliography.

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		Language
ID/WG.99/61 + Summary	Use of Fertilizers on Non-irrigated Soil in the USSR By D.A. Korenkov Vienna, 1971. 32 p. Tables. Discusses the effects of nitrogen, phosphate, and potassium fertilization on crop yields under various climatic conditions and with a variety of soils. Statistics.	E E F S R
ID/WG.99/62 + Summary	Experience in the Use of Fertilizers for Tea and Sub-tropical Crops in the USSR By O.G. Oniani Vienna, 1971. 23 p. Tables. Publication on the use of fertilizers for tea, citrus fruit, and laurel crops in the USSR. - Discusses the improvement in sub-tropical crop yields through the application of mineral fertilizers (to counteract nitrogen, phosphorus, potassium, and magnesium deficiencies of soils) together with organic fertilizers and a wide range of special techniques in agriculture (e.g. liming of acid soils). Statistics.	E E F S R
ID/WG.99/63 + Summary	Simulators for Training Plant Personnel By R.E. Buckley Vienna, 1971. 17 p. Discusses methodology of training operators by simulation and evaluates a current model process trainer which can be converted for use by all fertilizer component manufacturers.	E E F S R
ID/WG.99/64/ Rev. 1 ID/WG.99/64 Summary	Stamicarbon's Urea Stripping Process By J.D. Logemann Vienna, 1971. 33 p. Diagrams. Covers (1) Heat economy (2) Description of the process and typical features thereof (3) Carbon dioxide compression by means of steam driving (4) Corrosion and corrosion prevention. Flow Charts, Process Statistics.	E E F S R
ID/WG.99/65 + Summary	Production of Ammonium Polyphosphate and Liquid Fertilizer from 52 - 54 per cent Phosphoric Acid By I. Kotlarevsky Vienna, 1971. 24 p. Tables, Diagrams. (1) Describes briefly a semi-industrial pilot plant in France applying a modified TVA process (2) Discusses raw materials, finished products, economic aspects, and various problems encountered (3) Outlines a programme of development and experiments. Statistics, Flow Chart.	E E F S R
ID/WG.99/66 + Summary	Organizing and Controlling Maintenance in Fertilizer Plants By C.G. Barnes, R.S. Ray Vienna, 1971. 31 p. Discusses changes in maintenance management; maintenance needs and setting up of maintenance departments; training of workers; planning and scheduling; preventive and predictive maintenance; downtime utilization; task force approach; corrective maintenance after repair; spare parts; repair problems.	E E F S R

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Language

ID/WG.99/67 + Summary
Financing New Fertilizer Plants in India — E
By S.K. Subramanian — E F S R
Vienna, 1971. 21 p.

(1) Discusses industrial projects assisted by the Industrial Development Bank of India (IDBI) (2) Outlines the role of promoter groups and foreign collaboration regarding project evaluation, project implementation, licensing of knowhow and engineering design, etc. (3) Covers problems of location of industry, marketing, foreign exchange requirements and other financial aspects.

ID/WG.99/68 + Summary
The Role of Fertilizers in the Green Revolution — E
By A.C. McClung — E F S R
Vienna, 1971. 39 p. Graphs.

Publication on the role of fertilizers in increasing food production. - Discusses (1) Development of new cereals varieties (of rice, wheat, maize, millet) to reach high crop yields (2) Seasonal and varietal differences in nitrogen responsiveness (3) Impact of new technology on rice production in the Philippines and West Pakistan (4) Other plant nutrients. Bibliography, Statistics.

ID/WG.99/69 + Summary
Repair and Maintenance of Fertilizer Plants — E
By J. Michel — E F S R
Vienna, 1971. 17 p. Diagrams.

Discusses the optimization and planning of preventive and previsional maintenance and maintenance for accidental breakdown of various types of equipment, considering life time, maintenance costs and availability.

ID/WG.99/70 + Summary
Computers Serving the Chemicalization of Agriculture — E
By N. Morgenthaller, J. Terenyi — E F S R
Vienna, 1971. 12 p.

Publication on electronic data processing for raising the effectiveness of fertilizer use. - Presents four mathematical models (developed by chemical industry in Hungary) designed to serve the needs of agriculture.

ID/WG.99/71 + Summary
Optimization of Development of the Fertilizer Industry — E
By G. Szatmari, A. Szanto — E F S R
Vienna, 1971. 13 p.

Presents linear programming models taking into consideration demand for and different types of fertilizers, existing production capacities, development potential, investment resources. etc.

ID/WG.99/72 + Summary
Indigenous Fertilizer Plant Manufacture — E
By D.N. Daruvalla — E F S R
Vienna, 1971. 11 p.

(1) Discusses (with the example of India) problems encountered in introducing indigenous engineering design and facilities for producing industrial equipment (2) Contains specifications and recommendations.

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		Language
ID/WG.99/73 + Summary	Role of FAO in Fertilizer Use Promotion in Developing Countries By M. Mathieu Vienna, 1971. 13 p. Covers (1) Development of demand by extension campaigns, marketing and credit institutions, marketing co-operatives and marketing boards, training (2) Evaluation of profitability of fertilizer use.	E E F S R
ID/WG.99/74 + Summary	ECA Assistance in the Promotion of the Fertilizer Industry in Africa Vienna, 1971. 6 p. Publication on ECA development aid in the promotion of the fertilizer industry in African member states . Outlines advantages of (1) Exploiting natural resources for the fertilizer industry and associated chemical industries (2) Pooling of markets on an interregional basis (3) Preparation of pre-feasibility studies to attract investments (4) Loans from development banks and international organizations.	E E F S R
ID/WG.99/75 + Summary	Fertilizer Supply in Developing Countries with Reference to Swedish Experience and Resources By O.H. Killingmo Vienna, 1971. 7 p. Publication on fertilizer supply in developing countries with reference to development aid from Sweden. - Discusses (1) Various ways of supply, e.g. imports of bags and bulk, domestic production based on intermediates or raw materials, etc. (2) Balanced development of the fertilizer industry and associated activities important for economic development.	E E F S R
ID/WG.99/76 + Summary	Foreign Assistance by the United States with Special Reference to Fertilizers By W.H. Garman Vienna, 1971. 4 p. Publication on USA financial aid and technical assistance to the fertilizer industry in developing countries. - Briefly describes the present and future assistance programmes of the Agency for International Development.	E E F S R
ID/WG.99/77 + Summary	Design and Fabrication of Fertilizer Plants Equipment in Developing Countries By K.S. Sarma, H.H. Jethanandani Vienna, 1971. 23 p. Discusses (with the example if India) (1) Recruitment and training of indigenous engineers and technicians under the guidance of foreign skilled personnel to make up for the lack of knowhow in establishment of new industry (2) Need for close co-operation between designers and manufacturers, raw materials testing, uniform standardization, and quality control.	E E F S R

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Language

ID/WG.99/78 + Summary
Training of Fertilizer Plant Personnel — E
By O.P. Agarwall — E F S R
Vienna, 1971. 20 p.

Publication on training of plant workers for the fertilizer industry in India. - Covers (1) Problems deriving from location of industry in rural areas, shortage of skilled workers and technical personnel, etc. (2) Vocational training, further training, and in-plant training for graduates and other staff in training centres (with repair shops, laboratories, etc.) to familiarize them with advanced technology.

ID/WG.99/79 + Summary
Training of Fertilizer Marketing Personnel — E
Published jointly with Fertilizer Association of India, New Delhi — E F S R
Vienna, 1971. 21 p. Tables.

Publication on training of marketing personnel in the fertilizer industry in India. - Discusses role of agriculture in economic development; increase in production capacity of fertilizer plants; liberalization and constraints of marketing; management development, including supervisors, dealers, and salesmen; training facilities offered by management institutes and associations, universities, in-plant training, government training programmes, training abroad, etc. Statistics.

ID/WG.99/80 + Summary
Choice and Development of Raw Materials and Feedstocks for the Fertilizer Industry — E
By V.N. Kasturirangan, P. Jayantha Rao — E F S R
Vienna, 1971. 25 p. Tables.

Publication on the choice of raw materials for the fertilizer industry in India. - (1) Discusses role of fertilizers in increased crop yields; present consumption and projections of future requirements; availability of capital, feedstocks (natural gas, coke oven gas, refinery gas, naphta, coke lignite, electrolytic hydrogen) and infrastructure (2) Lists installed and planned production capacities and describes other developmental work in the field of fertilizers. Statistics.

ID/WG.99/81 + Summary
Research and Development for the Fertilizer Industry — E
By K.R. Chakrovorty — E F S R
Vienna, 1971. 25 p.

Publication on research and development in the fertilizer industry (based on the example of India). - Discusses briefly (1) Organizational aspects and activities of the Fertilizer Corporation of India in the fields of testing, engineering design, planning, laboratory equipment, catalysts, pilot plant design, etc.

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		Language
ID/WG.99/82 + Summary	Snamprogetti Urea Stripping Process By U. Zardi Vienna, 1971. 24 p. Tables, Diagrams, Illustrations Covers process description; plant performances data (based on steam power and electric power balance, product quality, and operability); economic construction of single line plants with high production capacity; advantages of the new technique (e.g. saving in utilities, very high excess of ammonia to eliminate corrosion, minimum maintenance and repair, high on-stream productivity).Statistics, Flow Charts.	E E F S R
ID/WG.99/83/ Rev. 1 ID/WG.99/83 Summary	The Gulf Design Isothermal Phosphoric Acid Process By P.L. Bearden Vienna, 1971. 30 p. Diagrams. Publication on isothermal production of phosphoric acid to be used in fertilizers. - (1) Describes the Gulf design phosphoric acid process and lists advantages, e.g. lower capital investment, power consumption, and costs for operation and maintenance and repair; elimination of sulphuric acid dilution, rock drying and fine grinding for phosphate rocks; reduction in spare parts inventories; effective pollution control; etc. (2) Covers commercialization. Flow Charts.	E E F S R
ID/WG.99/84	Analysis of Responses to UNIDO Questionnaire on Problems of the Fertilizer Industry in Developing Countries Vienna, 1971. Various pagings, Tables. Identifies production, research and development, import, export, and marketing problems which are inhibiting the expansion of the industry. Statistics.	E
ID/WG.99/85 + Summary	Present Status and Future Development of the Fertilizer Industry in Selected Countries of the Middle East Vienna, 1971. 33 p. Tables. Covers (1) Consumption, availability of raw materials and fuel, present production, and future production capacity in a multilateral and regional perspective (2) Experience in the development of the industry and the role of UNESOB. Statistics.	E E F S R
ID/WG.99/86/ Rev. 1 ID/WG.99/86 Summary	The Role of the World Bank Group in the Development of the Fertilizer Industry in Developing Countries Vienna, 1971. 15 p. Covers (1) Problems and recent trends in fertilizer trade (2) Factors affecting soundness of the industry (3) Industrial promotion through financial aid, recommendations to Governments, studies and research (4) Objectives of IBRD assistance.	E E F S R

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		Language
ID/WG.99/87 + Summary	Satellite Fertilizer Plants in Developing Countries By A. Naustdal Vienna, 1971. 22 p. Tables Covers trade in raw materials (ammonia, phosphate rocks, potassium salts); imports of nitrogen, liquid phosphoric acid, etc.; establishment of new industry for the production of raw materials or intermediates; basic NPK factories; industrial planning in general; training and technical education in agriculture. Statistics, Bibliography.	E E F S R
ID/WG.99/88	Asian Development Bank's Assistance Activities in Agricultural Development and Fertilizer Industry in the Region By Dang Duc Tu Vienna, 1971. 9 p. Discusses (1) Functions of the Banks (2) Present and future financial aid activities in agricultural and fertilizer development.	E
ID/WG.99/89	Fertilizer Distribution and Transportation in India By P. Narain Vienna, 1971. 12 p. Covers (1) Assessment of supply and demand (2) Distribution problems of the central fertilizer pool and domestic manufactures (3) Methodology adopted to deal with railway transport, road transport, port operations, etc.	E
ID/WG.99/90/ Rev. 1	Conclusions and Recommendations (of 2nd Interregional Fertilizer Symposium) Vienna, 1972. 12 p. Refers to future meetings; knowhow; production of fertilizers, intermediates, and raw materials; engineering design; maintenance and repair; pollution control; planning; financing; establishment of new industry; training; marketing; development potential, etc.	E
ID/WG.99/91	Development of Advanced Methods for the Production of Concentrated Phosphoric and Compound Fertilizers,- Carried out within the Framework of CMEA By B.T. Kostov Outlines co-operation of member states in research and experimental work with reference to international division of labour and national planning.	E
ID/WG.99/92	Trends of Co-operation Among the CMEA Countries in the Use of Mineral Fertilizers By E. Schmidt Vienna, 1971. 25 p. Discusses co-ordination of research in the field of agriculture (by the Standing Commission on Agriculture) for the purpose of rational application of fertilizers with regard to soil, climatic and economic conditions.	E

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Language

ID/WG.99/93 The Fertilizer Industry of Brazil — E
By J. Juca Bezerra Neto
Vienna, 1971. 22 p. Tables, Graph, Maps.

Covers present demand for fertilizers and forecasts; need for imports due to high costs of raw materials; recent development of industry due to investment incentives established by government policies and exploration of raw materials. Statistics.

ID/WG.99/94 The Fertilizer Industry of the Arab Republic of Egypt — E
By M.A.E. Shaaban
Vienna, 1971. 6 p. Tables.

Discusses briefly the development and present status of the industry with reference to raw materials, production costs, and future exports, including consumption and production statistics.

ID/WG.99/95 The Fertilizer Industry of Ethiopia — E
By M. Bahta
Vienna, 1971. 15 p. Tables, Map

Deals briefly with crop yield, consumption, forecasts of future requirements, distribution, and a contemplated pre-feasibility study on fertilizers and pesticides. Statistics.

ID/WG.99/96 The Fertilizer Industry of India — E
By V. Rama Iyer
Vienna, 1971. 20 p. Tables.

Deals briefly with fertilizer promotion, distribution, imports, production capacity, feedstocks, training of technical personnel and skilled workers, research and development, maintenance and repair, demand forecasts, and development potential. Statistics.

ID/WG.99/97 The Fertilizer Industry in Indonesia — E
By N. Kansil
Vienna, 1971. 11 p. Tables.

Discusses briefly present fertilizer production capacity, plans for development, consumption, projections, imports, raw materials, etc. and refers to the participation of the private sector. Statistics.

ID/WG.99/98 The Fertilizer Industry of Iran — E
By E. Bahari
Vienna, 1971. 34 p. Tables, Floor Plan, Map.

Covers fertilizer demand, production capacity, production costs, future development of the industry, and financing of fertilizer projects. Statistics, Factory Layout.

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Language

ID/WG.99/99 — The Fertilizer Industry of Iraq — E
By M.H. Al-Shukri
Vienna, 1971. 4 p.

Briefly outlines beginning application of fertilizers and mentions a trial operation at a pilot plant based on natural gas and sulphur.

ID/WG.99/100 — The Fertilizer Industry of Israel — E
By T. Gans
Vienna, 1971. 19 p. Tables

Discusses (1) Existing industries with reference to available raw materials (natural gas, refinery gases, phosphate deposits), production capacity, imports of nitrogen, exports of phosphate rocks and potassium fertilizers, etc. (2) Domestic market. Statistics.

ID/WG.99/101 — The Fertilizer Industry of Mexico — E
By E. Bosque Lastra
Vienna, 1971. 27 p. Tables.

Discusses briefly the historical development of the industry and current problems, covering production capacity, production costs, prices, imports, exports, consumption, etc. Statistics.

ID/WG.99/102 — The Fertilizer Industry of Nigeria — E
By E.A. Essien
Vienna, 1971. 22 p. Tables.

Discusses briefly the development of the industry; present consumption based on imports; demand projections; establishment of domestic production based on feasibility studies of several fertilizer projects. Statistics.

ID/WG.99/103 — The Fertilizer Industry of Peru — E
(not abstracted)

ID/WG.99/104 — The Fertilizer Industry of the Philippines — E
By B.C. Alip
Vienna, 1971. 16 p. Tables

Discusses historical background, production capacity, various processes, research and development, planning, imports, exports, domestic consumption, marketing, distribution, government policies, etc. Statistics.

ID/WG.99/105 — The Fertilizer Industry of Poland — E
By B. Skowronski
Vienna, 1971. 8 p. Tables

Briefly discusses fertilizer consumption and supply, offering projections to 1980. Statistics.

ID/WG.99/106 — The Fertilizer Industry of Romania — E
(not abstracted)

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		Language
ID/WG.99/107	The Fertilizer Industry of Sudan By H.O. Burhan Vienna, 1971. 13 p. Tables. Discusses briefly (1) The development of agriculture according to the national plan with reference tc crop yield responses to imported fertilizers (2) The establishment of a domestic production based on a feasibility study. Bibliographycal notes, Statistics.	E
ID/WG.99/108	The Fertilizer Industry of the Syrian Arab Republic By I. Lahham Vienna, 1971. 5 p. Briefly discusses irrigation schemes to augment the agricultural area; increasing demand for fertilizers; necessity for imports; production of nitrogen and superphosphate fertilizers in a pilot plant and another small plant; development potential of the industry as envisaged in the national plan.	E
ID/WG.99/109	The Fertilizer Industry of Thailand By B. Udomsakdhi Vienna, 1971. 8 p. Discusses promotion of fertilizer application to counteract the declining export value of agricultural products; trends in fertilizer consumption and production with reference to production costs.	E
ID/WG.99/110	The Fertilizer Industry of Turkey By D. Abdusselamoglu, N. Deliormanli Vienna, 1971. 9 p. Tables. Discusses production capacity, necessary imports, and domestic consumption. Statistics.	E
ID/WG.99/111	The Fertilizer Industry of Yugoslavia By V. Acimovic, B. Frusic Vienna, 1971. 4 p. Briefly discusses production of nitrogen and superphosphate fertilizers from natural gas and phosphate rocks with reference to demand and production capacities.	E
ID/WG.99/112	The Fertilizer Industry of Zambia By D. Ben Kajimo Vienna, 1971. 21 p. Tables. (1) Discusses briefly the historical background and development potential of the industry with reference to certain planning problems (2) Covers production capacity together with process descriptions, imports, consumption, distribution, and legal aspects. Statistics.	E
ID/WG.99/113 (ID/94) (72.II.B.31)	Recent Developments in the Fertilizer Industry (Report of the 2nd Interregional Fertilizer Symposium) New York, 1972. 119 p. Tables. Covers (1) World production and world consumption; technology for ammonia, nitrogen, phosphate and potash fertilizers; raw materials and intermediates for fertilizer production (2) Engineering design of new plants and pollution control; economic aspects, including planning and financing, marketing and distribution. Recommendations, Statistics, Agenda, List of Documents.	E R

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Expert Group Meeting on the Transfer of Know-How in the Production and Use of Catalysts, Bucharest, Romania, 26 - 30 June 1972
(Organized by the Joint UNIDO/Romania Centre)

		Language
ID/WG.123/2	Aide-Mémoire Vienna, 1972. 6 p. Aide Mémoire for a meeting on knowhow and technology transfer with regard to catalysts.	E F
ID/WG.123/5	Development, Production and Use of Fertilizer Catalyst in India By P.S. Sen Vienna, 1972. 58 p. Illus., Tables, Graphs. Describes (1) The increase in world production of ammonia and the development of knowhow for ammonia synthesis catalyst in India (2) The techniques of fertilizer catalyst production and uses in desulphurization, high and low temperature shift conversion, sulphuric acid, etc. Statistics, Bibliography.	E
ID/WG.123/6	Phosphoric Acid as a Catalytic Medium for Organic Reactions By L.M. Shorr Vienna, 1972. 16 p. Describes (1) The chemical transformations in sulphuric acid, mentioning the trend towards reducing the consumption of co-product ammonium sulphate as a fertilizer in developing countries (2) Experiments (Beckmann rearrangement and Ritter reaction) involving the use of phosphoric acid as a substitute for sulphuric acid. Recommendations, Bibliography.	E
ID/WG.123/7	New Trends in Catalysis By J. Manassen Vienna, 1972. 16 p. Publication on technology transfer for the development of catalysts. - Describes various new processes for the production of chemicals such as ammonia, methanol, etc., through catalyst improvement, underlining the importance of investment and choice of technology adapted to local conditions in developing countries. Chemical formulae.	E
ID/WG.123/8	Current Problems in Scientific-Technical Co-operation in Catalysis Between a Research Institute and Industry in Yugoslavia By P.S. Putanov Vienna, 1972. 18 p. Tables. Covers (1) The development of the chemical and petroleum industries based on available raw materials, giving production capacities and production statistics (2) The need for training programmes and standardization in catalysis research methods. Statistics.	E

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Language

ID/WG.123/9 Preparation of Aromatics from Catalytic Reforming of Petroleum Fractions — E

By A. Pallah, A. Badakhshan, M. Shahab, A.H. Azimipour, F. Kamali
Vienna, 1972. 21 p. Tables, Graphs, Diagrams.

Publication on the production of aromatics (petrochemicals) using a platinum catalyst. - Describes experiments carried out on two gasoline fractions at different temperatures and pressures in a catalytic reforming pilot plant. Statistics, Bibliography, Flow Charts.

ID/WG.123/10 Hydrodesulphurization of Fuel Oil Using CO-MO Catalysts — E

By M. Shahab
Vienna, 1972. 6 p.

Publication on hydrodesulphurization of petroleum fuel oil using CO-MO catalysts (pollution control measure). - Describes (1) Research carried out in Iran on a process to remove sulphur from petroleum products (2) Results of experiments using hydrogen pressure.

ID/WG.123/11 Technico-Economical Aspects Related to Heat-Recovery in Heterogeneous Catalytic Processes — E

By V. Ciort, D. Ciocotoiu, I. Zirma, S. Despa, D. Grigoriu
Vienna, 1972. 16 p. Tables, Graphs, Diagrams.

Publication on methods of heat recovery in heterogeneous catalytic (catalyst) processes used in the petrochemical industry. - Discusses technical aspects and economic aspects of a hydrogen treatment process, drawing attention to equipment costs, power consumption, production costs, etc. Statistics, Bibliography.

ID/WG.123/12 Methods for Estimation of Crude Oil Processing Catalyst Activity — E

By M.A. Barbul, T.M. Filotti, I. Blidisil
Vienna, 1972. 20 p.

Publication on methods for testing catalyst performance in the crude oil (petroleum) processing industry. - Presents standard laboratory procedures and equipment for the evaluation of the catalysts used in gasoline reforming processes, mentioning their adaptability to any oil processing industry in developing countries.

ID/WG.123/13 Some Aspects Related to the Development and Manufacture of Commercial Catalysts — E

By I. Ghejan
Vienna, 1972. 24 p. Tables, Graphs, Diagram.

Publication on research and development on catalysts for the petrochemical industry. - Discusses economic aspects and the necessity for co-operation between researchers and equipment manufacturers, giving examples of catalyst manufacture using active alumina. Statistics, Bibliography.

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Language

ID/WG.123/14 — The Physical and Mathematical Modelling of a Process for some Alkylaromatics Dehydrogenation in Adiabatic System — E

By V. Mocearov, S. Popa, G. Csomontanyi, G. Panaitescu, A. Panovici
Vienna, 1972. 14 p. Graphs, Tables.

Publication on the experience of a Romanian research centre in the field of heterocatalytic (catalyst) processes for the production of styrene (petrochemicals). - Describes experiments performed in an adiabatic pilot plant (physical model) which supplied data for mathematical models used in testing various improved types of dehydrogenation. Statistics, Bibliography.

ID/WG.123/15 — Economic Small Size Phthalic Anhydride Plant and a Small Plant for the Manufacture of Catalysts — E

By O.F. Joklik
Vienna, 1972. 118 p. Illus., Tables, Diagrams, Floor Plan.

Describes (1) Processing in small plants, with reference to economy of scale, production costs, production capacities, raw materials, equipment and manpower needs, engineering design, etc. (2) Industrial application as intermediates in the manufacture of plastics, resins coatings, paints and varnishes, etc. Extensive Bibliography and patents, Statistics, Factory Layout, Flow Charts.

ID/WG.123/16 — Activity and Life of Catalysts for the Production of Ammonia — E

By S.P.S. Andrew
Vienna, 1972. 28 p. Graphs, Diagrams.

Discusses (1) The activity and life of various catalyst in steam naphta and methane reforming, desulphurization, etc. (2) Importance of reliable catalysts in all stages of ammonia synthesis and the effects of oxygen. - Containing compounds, mentioning implications for developing countries.

ID/WG.123/17 — Catalysts Used in the Fertilizer Industry in Turkey — E

By R.S. Oenuer
Vienna, 1972. 3 p.

Briefly delas with technical aspects and problems faced in connection with the catalysts used in CO-conversion and ammonia synthesis, with implications for equipment design.

ID/WG.123/18 — Present Status and Future Possibility of Catalysts Production in India — E

By A.H. Lalljee
Vienna, 1972. 20 p. Tables.

Deals with (1) Import substitution through the domestic production of catalysts for ammonia manufacture and with the possibility of exporting them to other West Asian countries (2) Technical aspects and the importance of knowhow and technical services. Statistics.

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Language

ID/WG.123/19 — Vinyl Chloride Production by Catalytic Dehydrohalogenation of 1.2 Dichloroethane — E

By F. Colunga, J.M. Ferreira
Vienna, 1972. 24 p. Tables, Diagrams.

Publication on the use of alumina-based catalysts in the production of vinyl chloride. - Describes an experimental process involving catalytic dehydrohalogenation fo 1.2 dichloroethane in a pilot plant in Mexico. Bibliography, Statistics.

ID/WG.123/20/ Rev.1
ID/WG.123/20 Summary — Catalyst Testing — E

By R.W. Bedford
Vienna, 1972. 22 p. Diagrams.

Publication on testing techniques for catalyst performance (based on the experience of Imperial Chemical Industries, UK). - (1) Defines three levels of catalyst testing, presenting various types of tests (with chemical reactors used) and their application to particular catalysts (2) Mentions their advantages in research activity and catalyst manufacture and use. Flow Chart.

ID/WG.123/21 — A Survey of Developments in Reactor Technology (Reactors for Catalytic Gas-Phase Processes) — E

By O.F. Joklik
Vienna, 1972. 47 p. Diagrams. Illustrations.

Describes mercury-cooled and salt bath-cooled reactors, oxidation reactors, etc., with attention to technical aspects, production capacities, and automatic control systems. List of basic Patents.

ID/WG.123/22 — Factors Affecting the Decision of Manufacture Catalysts — E

By. B. Cramer
Vienna, 1972. 10 p.

Deals with various types of petrochemicals catalysts and discusses technology and market considerations, supply of raw materials, size of enterprise, investment, equipment, in-process controls and training for technical personnel.

ID/WG.123/23 — Improved Economics in Catalytic Reforming — E

By C.J. Obaditch, J.A. Nevison, M.H. Dalson
Vienna, 1972. 28 p. Tables, Diagrams, Graphs.

Publication on new types of catalysts and improved petrol catalytic reforming techniques developed in the USA. - Covers new trends in operating techniques, polymetallics (metals) and platinum rhenium catalysts, etc., comparing them with past catalytic reforming, and underlining their economic advantages through higher yield of reformate and hydrogen, higher quality standards and reduced costs per unit of product. Statistics, Flow Chart.

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		Language
ID/WG.123/24	New Techniques in Economic Evaluation of Catalyst Efficiency Vienna, 1972. 16 p. Tables, Diagram. Publication on microtechniques for the economic evaluation of catalyst performance. - Deals with the use of catalysts for laboratory or pilot plant scale experiments; testing, planning and selecting specific catalytic processes, etc., emphasizing the theoretical approach to determine catalyst efficiency. Statistics, Bibliography.	E
ID/WG.123/25	Trends in the Development of Catalytic Petroleum Refiring Processes By I. Ghejan Vienna, 1972. 80 p. Diagrams, Graphs, Tables. Covers (1) Development of catalytic processes and cracking of heavy distillates, reforming and manufacture of light high-octane petrol (2) Hydrogen treating processes to improve quality standards, etc. (3) Hydrocracking and catalytic hydrogenation, need for lead-free petrol as a pollution control measure, etc. Extensive Bibliography, Flow Charts, Statistics.	E
ID/WG.123/26	Research and Production of Catalysts By I.V. Nicolescu Vienna, 1972. 19 p. Graphs, Diagrams. Publication on catalyst research and development in Romania. - Covers (1) Organizational aspects of the co-operation between research centres and the chemical industry in the field of catalyst development, including laboratory testing for commercial and pilot plants (2) Catalysts manufactured in Romania for the fertilizer and petrochemical industries, and the role of research in the development of new types of catalysts.	E
ID/WG.123/27/ Rev.1	Report on the Expert Group Meeting on the Transfer of Know-How in the Production and Use of Catalysts Vienna, 1972. 21 p. Covers (1) Factors concerning development of catalysts for the fertilizer and petrochemical industries in developing countries, i.e. standardization, research and development, adequate equipment and testing facilities (2) Requirements for transfer of know-how; new trends and the role of UNIDO in connexion with training assistance, information service, pilot plants, etc. Recommendations.	E
ID/WG.123/28	Report of the Expert Group Meeting (see also above) Vienna, 1975. 287 p. Tables, Graphs, Diagrams (1) Comments on papers presented and issued discussed (2) Reproduces papers submitted to the meeting. Recommendations, Statistics, Bibliographies.	E

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Meeting for Identification and Development of Fertilizer and Pesticide Industries in the Developing Countries Served by ECE, Bucharest, Romania, 10 - 14 July 1972

(Organized by the Joint UNIDO/Romania Centre)

		Language
ID/WG.127/4	Trends in Fertilizer Production By T.P. Hignett Vienna, 1972. 60 p. Graphs, Diagrams. Covers (1) Increased consumption (2) Increased concentration and trend towards compound fertilizers (3) Larger plants (size of enterprise) (4) Complexity of formulation, use of intermediates (5) Nitrogen materials; phosphate materials; liquid and suspension fertilizers; ammonia polyphosphate; nitric and potassium phosphates (6) 'Controlled release' fertilizers, including potash. Bibliography, Statistics.	E
ID/WG.127/5	Sulphuric Acid Production Technology and Plant Construction in Poland By J. Wozniakowski Vienna, 1972. 24 p. Tables, Diagram. Covers sulphur and other raw materials, including problems of storage and transportation; capital costs and production costs; export of sulphuric acid and of complete plants, etc.	E
ID/WG.127/7	Report of the Meeting for the Identification and Development of Fertilizer and Pesticide Industries in the Developing Countries served by ECE Vienna, 1972. 13 p. (1) Covers the objectives and organizational aspects of the meeting and visits to the Craiova Chemical Complex and the Fundulea Agricultural Research Institute (Romania) (2) Makes recommendations regarding identification of problems with attention to increasing development potential and the role of UNIDO therein. List of Documents.	E
ID/WG.127/10	Status of the Fertilizer and Pesticide Industries in Bulgaria By S.G. Gaitandjiev, S.N. Lazarov Vienna, 1972. 6 p. Covers present status in the production of ammonium nitrate, urea, phosphates, fungicides and herbicides, drawing attention to problems of quality control, plant reconstruction, supply of raw material for pesticides, etc.	E

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Language

ID/WG.127/11 — Status of Fertilizer and Pesticide Industries in Cyprus — E

By P. Markou, A.M. Papakyriakou, J.P. Zymgas
Vienna, 1972. 26 p. Tables, Graphs.

(1) Reviews the existing status of the industries with respect to domestic consumption, imports and exports, common problems (2) Gives calculations on production trends, import statistics, etc.

ID/WG.127/12 — Status of the Fertilizer and Pesticide Industries in Hungary — E

By F. Hargitai, T. Zsifkov
Vienna, 1972. 8 p.

(1) Covers development trends over the recent past, with special reference to problems such as inadequate supply of single and compound fertilizers, of active ingredients for pesticides, etc. (2) Notes rising use of plant protection chemicals and especially herbicides, and further development potential, with due attention to pollution control.

ID/WG.127/13 — The Importance of Pilot Plants for Industrial Development of New Processes — E

By I. Moldovan
Vienna, 1972. 6 p.

Publication on the function of pilot plants in research and development (with relation to the fertilizer industry) - (1) Briefly outlines various stages in research of product design (laboratory research, systematic research, design of pilot plant, etc.) and operational methods of such plants (2) Proposes the establishment of a universal experimental plant for pesticides, with assistance from UNIDO.

ID/WG.127/14 — Status of the Fertilizer and Pesticide Industries in Poland — E

By J. Simonides, S. Byrdy
Vienna, 1972. 20 p. Tables.

(1) Gives a short history of the nitrogen industry together with consumption and production statistics, types of fertilizer produced, raw materials, domestic prices and exports of nitrogenous fertilizers (2) Covers testing and production of pesticides, particularly Colorado beetle pest control for potatoes crops. Statistics, Maps.

ID/WG.127/15 — Status of the Fertilizer and Pesticides Industries in Turkey — E

By C. Bueyuekakinci, G. Cankara
Vienna, 1972. 12 p.

(1) Covers the background and present situation with respect to raw materials, processing techniques, supply and demand, production capacities, production costs, manpower and training, etc. (2) Gives production statistics and forecasts.

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Language

ID/WG.127/16 — Status of the Fertilizer and Pesticide Industries in Yugoslavia — E

By A. Vizovisek
Vienna, 1972. 8 p.

Covers the recent growth in production of ammonia, nitric acid, urea, mixed fertilizers, etc., mentioning the need of correlation between production capacity and consumption (2) Gives a break-down of production figures for pesticides, citing problems affecting development potential.

ID/WG.127/17 — Summary of the Report on the Chemical Fertilizer Production and Consumption in Albania, Bulgaria, Czechoslovakia, Cyprus, Greece, Yugoslavia, Malta, Poland, Romania, Spain, Turkey and Hungary — E

By N. Popovici, A. Manciulescu, A. Pirscoveanu Apostolide
Vienna, 1972. 37 p. Tables.

Gives (1) Consumption and production trends and projections to 1990 for the above-mentioned 12 European countries (2) Brief information on the fertilizer industry by country, covering raw materials and development potential. Statistics, Bibliography.

ID/WG.127/18 — Identification and Development of the Fertilizer and Pesticide Industries in the Developing Countries Served by ECE. Report of an Expert Group Meeting, Bucharest, 1972 — E

Vienna, 1974. 133 p. Tables, Graphs, Diagrams.
(Published in co-operation with Joint UNIDO/Romania Center)
(See also ID/WG.127/7 above)

(1) Covers organization of the meeting, field trips to a chemical industry complex and a research centre in Romania (2) Reproduces papers submitted by consultants and country papers concerning Bulgaria, Cyprus, Hungary, Malta, Poland, Romania, Turkey and Yugoslavia.
Recommendations, Statistics, Bibliography.

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Expert Group Meeting on Minimizing Pollution from Fertilizer Plants
Helsinki, Finland, 26 - 31 August 1974

		Language
ID/WG.175/2	Notes on the Elimination of NOx in Tail-Gas in Medium-Pressure Nitric Acid Plants. Preliminary Study of a New Absorption Process By D.J. Olivares Vienna, 1974. 15 p. Tables, Diagrams. Publication on pollution control for fertilizer industry, with special reference to nitric acid plants. (1) Covers technology of nitric acid production at medium pressure and problems of tail-gas abatement (2) Presents basic ideas for development of a process for the absorption of nitrogen oxide in tail-gas using urea solution, assessing relevant patents and reporting on experiments conducted with a filling model.	E
ID/WG.175/3	Establishment of a pragmatic mathematical approach for Predicting Particulate Matter Emissions from Fertilizer Plants (not abstracted)	E
ID/WG.175/4	The Influence of Effluent Standards on the Economics of Alternative Wastewater Treatment Designs By F. Lora, A. Masia Vienna, 1974. 13 p. Tables, Flow-Charts. Publication on pollution control for fertilizer industry, with special reference to effluent treatment and waste disposal. - Covers (1) Wastewater evaluation (2) Effluent requirements, referring to legislation in Spain (3) Alternative designs for water treatment (4) Economic aspects. Bibliography, Diagrams.	E
ID/WG.175/5	The Use of the Alonizing Process in Sulphuric Acid Plant Construction By W.A. McGill, M.J. Weinbaum Vienna, 1974. 22 p. Diagrams. Publication on pollution control for fertilizer industry, with special reference to sulphuric acid plants. - Discusses (1) Manufacture of sulphuric acid and attendant pollution problems (2) Pollution control standards and techniques in the USA (3) The alonizing process (i.e. a pack cementation operation during which aluminium, in a high temperature vapour phase, is diffused into the surface of the heat exchanger tubes) and its application by three plants (4) Fabrication techniques. Bibliography.	E

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		Language
ID/WG.175/6/ Rev.1	The Purification of Gaseous Waste Streams from Nitric Acid Plants which Contain Nitrogen Oxides By W.R. Hatfield Vienna, 1974. 24 p. Graph, Diagrams. Publication on pollution control for fertilizer industry, with special reference to nitric acid production. - Discusses a method for removal of nitrogen oxides from waste tail gas, covering (1) Chemistry and thermodynamics (2) Catalyst and kinetics (3) Equipment design and economic aspects. Bibliography.	E
ID/WG.175/7	Influence of Environmental Protection on the Fertilizer Production Technologies By. A.D. Almasy Vienna, 1974. 25 p. Graphs, Diagram. Publication on pollution control for fertilizer industry. - (1) Discusses the situation facing the industry after worldwide introduction of environmental considerations, with special reference to effects on production planning (2) Covers choice of technology for elimination of pollutants and possible waste utilization, including economic aspects. Statistics, Bibliography.	E
ID/WG.175/8	Modern Technology for Minimizing Pollution from Fertilizer Plants By L. Whalley Vienna, 1974. 25 p. Tables, Flow Chart. Discusses advanced technologies applicable to plants, covering nitric acid, sulphuric acid, phosphoric acid and super-phosphates, ammonium nitrate, waste water treatment for a nitrogenous fertilizer plant, etc. Bibliography, Diagram.	E
ID/WG.175/9	Environmental Pollution from Fertilizer Production in India - Some Case Studies By J.M. Dave Vienna, 1974. 43 p. Covers (1) Indian fertilizer production capacity and demand (2) Environmental pollution problems (air, water, solid wastes), presenting four case studies of plants with reported accidents and episodes of severe pollution (3) Costs of control measures (4) Institutional framework for pollution control and environmental engineering. Statistics.	E
ID/WG.175/10	Solutions for Minimum Pollution in Nitrogen Fertilizer Plants By E.C. Bingham Vienna, 1974. 47 p. Tables, Graphs, Diagrams. Outlines nitrogen fertilizer manufacturing processes, indicating solutions to problems of (1) Waste water treatment (2) Air pollution (3) Noise, thermal, and solid waste pollution. Bibliography, Statistics, Flow Charts for production of ammonia, nitric acid, urea, etc.	E

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Language

ID/WG.175/11 — Measures to Minimize Aqueous Waste Pollution from Fertilizer Plants Situated in an Integrated Chemical Complex — E

By F. Dijkastra
Vienna, 1974. 32 p. Tables, Graphs, Diagrams.

Publication on pollution control for fertilizer industry, based on experience in the Netherlands. - Outlines situation at plants forming part of a large integrated chemical industry complex, discussing (1) Existing facilities for waste water treatment and purification processes (2) Measures planned for re-conditioning of effluent discharge (3) Reconditioning of existing plants (4) Central purification installations (5) Points to be considered in construction of new plants. Maps, Bibliography.

ID/WG.175/12 — Minimizing Pollution from Phosphate Fertilizer Plants Including Captive Acid Plants — E

By T. Kivela
Vienna, 1974. 37 p. Diagrams.

Covers (1) Problems of purification, water treatment and waste utilization arising in the production of (A) sulphuric acid (B) superphosphate (C) wet-process phosphoric acid (involving gypsum disposal) (D) complex fertilizers (2) Environmental protection measures at plants in Finland. Bibliography.

ID/WG.175/13 — Pollution from Fertilizer Plants in Bangladesh — E

By A. Huq
Vienna, 1974. 26 p. Tables.

(1) Provides background information on the industry, covering past and projected fertilizer consumption, present production (ammonia-urea) and future programme (2) Discusses river pollutants and acute problems of waste water treatment; toxicity effects on fish; required remedial measures, etc. Statistics.

ID/WG.175/14 + Summary — Pollution Abatement in an Urea Plant — E

By T. Jojima, T. Sato
Vienna, 1974. 21 p. Diagrams. (Summary 2 p.)

Covers (1) Urea process in general and sources of pollution (contaminated gland cooling water, urea dust, gases, etc.) (2) Prilling tower dedusting system (air cleaning) (3) Process condensate from a vacuum concentrator. Flow Charts, Statistics.

ID/WG.175/15 — Utilization of By-Products from the Wet Phosphoric Acid Production to Prevent Environmental Pollution — E

By E. Steininger
Vienna, 1974. 19 p. Diagrams.

Publication on pollution control for fertilizer industry, with special reference to utilization of fluorine and gypsum by-products from wet phosphoric acid production. - Covers (1) Uses of gypsum in the construction industry, the fertilizer industry, and for production of sulphuric acid and cement clinker (2) Possibilities of fluorine waste utilization, describing some processes.

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Language

ID/WG.175/18 — Fertilizer Industry - Environment Pollution Source. Technical Solutions and Technological Advances Made in Romania to Control Environmental Pollution Effects — E

By N. Popovici
Vienna, 1974. 46 p. Tables, Diagrams, Illustrations.

Describes status of the industry and measures (in location of industry and choice of technology) required for protection of the environment (2) Considers pollution problems in production of sulphuric acid; wet phosphoric acid; single superphosphate; ammonia out of methane hydrocarbons ; urea; ammonium nitrate; nitric acid; complex fertilizers and nitro-phosphates. Statistics.

ID/WG.175/19 (ID/140) — Minimizing Pollution from Fertilizer Plants. Report of an Expert Group Meeting, Helsinki, 26-31 August 1974 — E F R

Vienna, 1974. 38 p. Tables.

Summarizes papers and discussions commenting on (1) Recent developments regarding (A) water pollution (effluent) and water treatment (B) disposal, through recycling, of gypsum and fluoride (fluorine) (C) urea dust (2) Nitrogenous and phosphate fertilizer plants (3) Equipment: economic aspects (4) Standards (in USA), also concerning air pollution (5) Legislation and regulations (6) The role of UNIDO. Recommendations, List of Documents. Statistics.

ID/WG.175/20 — UNIDO's Role in Assisting Developing Countries to Minimize Pollution from Fertilizer Plants — E

(not abstracted)

ID/WG.175/21 — Federal Legislation and Discharge Limits (Air-Water) for Fertilizer Manufacturing Plants in the United States — E

By R.R. Swank
Vienna, 1974. 25 p. Tables.

Covers (1) Federal environmental legislation, citing main features of Water Pollution Control Law of 1972 and the Clean Air Amendments of 1970 (2) Legislative criteria for control of aqueous effluents and air pollution (3) Allowable discharges for fertilizer industry (4) Sources of technical information on (A) supporting technology for discharge limits (B) relevant research and development with emphasis on water treatment and recycling. Bibliography.

ID/WG.175/22 — Some Environmental Problems in Developing Fertilizer Industry with Reference to Indonesia — E

By A. Wirjoasmoro
Vienna, 1974. 3 p.

Briefly covers need for assessment of the effects of industrial processes and products upon the environment, with consideration to be given to social, cultural, ecological, technical aspects and economic aspects.

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Language

ID/WG.175/23 — The Fertilizer Industry in Mexico and the Pollution Problems — E

By G.J. Avila
Vienna, 1974. 12 p.

(1) Lists plants now functioning and their main products (2) Covers (A) government policy on environmental protection, citing regulations (B) fume and dust emissions (air pollution) (C) waste water pollution and water treatment (D) gas emissions.

ID/WG.175/24 — Direct Reduction of Fluorapatite in Fluid-phase Carrier: Conceptual Applications to Pollution Control, and Other Implications — E

(not abstracted)

ID/WG.175/25 — Environmental Regulations Confronted by Fertilizer Producers in the United States — E

By J. Reynolds
Vienna, 1974. 20 p. Graphs, Diagrams.

Discusses relevant regulations proposed by the U.S. Environmental Protection Agency (EPA) and reactions of the industry, covering (1) Effluent discharge limitations and guidelines (2) Abatement costs (3) Air emission standards (4) Water pollution abatement technology for phosphate production (5) 1977 allowable discharge levels for phosphorus, fluoride, ammonium nitrate, nitrogen, etc. Statistics.

Regional Consultation for the Arab Countries of the Middle East and North Africa on Licensing of Technology with Reference to the Petrochemical and Fertilizer Industries
Benghazi, Libyan Arab Republic, 1 - 6 December 1975

ID/WG.219/5 — Transfer of Technology in the Fertilizer Industry — E

By J.D.C. Hemsley
Vienna, 1975. 17 p.

Covers: Growth of technology transfer; choice of technology; commercial and legal aspects; the license contract; costs of technology transfer; responsibility in licensing; the transfer of technical information.

ID/WG.219/6 — The Cost of Technology Transfer in the Petrochemical and Fertilizer Industry — E

By B. Hedberg
Vienna, 1975. 22 p. Graph, Diagrams.

Publication on the costs of technology transfer (international licensing) - (1) Covers (A) in-house research and development versus acquired technology (B) cost of technology, considering product development, process development, choice of technology, cost of licensing (C) transfer mechanism (2) Describes (A) cash flow in innovation process (B) turnover based on own research and on acquisition of new technologies.

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Language

ID/WG.219/7 — Factors Influencing Process Selection, Plant Size and License Fees in the Petrochemical and Fertilizer Industry — E

By B. Hedberg
Vienna, 1975. 37 p. Tables, Graphs, Diagrams.

Publication on licensing of technology for the petrochemical industry and fertilizer industry, with special reference to process selection for new ventures. - Covers (1) Factors affecting process selection, considering (A) size of enterprise, economy of scale, cost output ratio (B) license costs (2) Case study of evaluation and choice of technology offered for same process (production of vinyl chloride). Statistics, Process Flow Charts.

ID/WG.219/8 — Transfer of Technology in the Catalyst and Petrochemical Industry — E

By J.W. Marshall, B.B. Pearce
Vienna, 1975. 15 p. Tables.

Publication on technology transfer through licensing in the catalyst and petrochemical industry. - Covers (1) Sources of technology and knowhow (mainly large manufacturing companies with research and development capacity, secondly engineering companies) (2) Approach of the Agricultural Division of ICI (UK) illustrated with regard to ammonia technology (3) Transfer of licensed information (4) Catalyst technology. List of licensed ICI processes.

ID/WG.219/9 — Report. (Consultation on Licensing and Technology for Petrochemical and Fertilizer Industry, 1975) — E

Vienna, 1975. 6 p.

Covers organization of the meeting, summarizes discussions and lists recommendations emphasising the role of UNIDO and of IDCAS in this field. Agenda.

Workshop in Fertilizer Technology
New Zealand, 10 - 21 November 1975

ID/WG.220/2 — Report on the New Zealand Workshop on Fertilizer Technology — E

Vienna, 1976. 27 p. Diagrams.

Report of a meeting on advanced technology available to fertilizer industry. - (1) Covers field trips undertaken, giving comments (2) Summarizes country papers describing conditions in Chile, India, Indonesia, Malawi, Mauritius, Philippines, Sri Lanka and Tanzania (3) Includes a 'Review of Fertilizer Manufacturing Facilities in New Zealand' and programme of a conference of the NZ Fertilizer Research Association. Recommendations, List of Documents, List of Participants, Maps.

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UNIDO/FAI Interregional Meeting on Safety in the Design and Operation of Ammonia Plants
New Delhi, India, 20 - 24 January 1976

		Language
ID/WG.221/1 + Summary	Safety in the Design Considerations of Ammonia Plants. Fact Experiences at Cochin and Udyogamandal Plants By S. Chidambaram Vienna, 1975. 9 p. Graphs, Diagrams. Publication on industrial safety considerations in process design of ammonia plants (based on experience with two plants in India). - Considers engineering design at plants with 600 TPD and 120 TPD capacities, based on steam power naphta reforming route, covering (1) High-pressure boilers and superheaters (2) Boiler water quality and silica deposits in turbines (3) Pipe construction material (4) Furnaces (5) LT conversion catalysts, etc. Process Statistics, Bibliography.	E
ID/WG.221/2	Safe Design and Operation of Ammonia Plants By. A.C. Ludbrook, M. Vos Vienna, 1975. 8 p. Publication on industrial safety aspects in design and operation of ammonia plants. - Highlights safety aspects to be considered, covering (1) The engineering design stage (4) Procedures at startup and during normal operation (5) Plant shutdown, etc.	E
ID/WG.221/3 + Summary	Steps to be Taken During Fabrication of Equipment to Ensure Safe Operation of Ammonia Plants By K.S. Sarma Vienna, 1975. 28 p. Stresses requirements to be met by equipment exposed to high pressures and temperatures, covering (1) Excellence of raw materials used (2) Pre and post welding heat treatment (3) Quality control aspects (4) Training for skilled workers and supervisors.	E
ID/WG.221/4 + Summary	Safety Consideration in the Design of Ammonia Synthesis Loops By A. Ward, A. Sunderland Vienna, 1975. 12 p. Publication on industrial safety in design of equipment for ammonia plants, with special reference to ammonia synthesis loops. - Covers (1) Operating conditions of ammonia loops and causes of recent plant shutdown (2) Process description, considering loops based on synthesis gas (A) from a reformer (B) from a partial oxidation plant (3) Measures to insure safety, considering engineering design, specifications, instruments, trip system, etc.	E

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Language

ID/WG.221/5 + Summary — Safety and Firefighting in Refineries and Fertilizer Plants — E

By S. Maruthappa
Vienna, 1975. 16 p.

Publication on industrial safety in petroleum refineries and fertilizer industry. - Covers (1) Philosophy of safety, required training, maintaining interest (2) Fire prevention; equipment and materials for fighting petroleum fires; process unit fires; dangers from pyrophoric deposits in gas lines and vessels (3) Toxicity of tetraethyl lead, hydrogen sulphide (sulphur) and ammonia, mentioning occupational disease hazards.

ID/WG.221/6 — General Aspects of Safety in Ammonia and Urea Plants and UNIDO's Technical Assistance to the Fertilizer Industry of Developing Countries — E

Vienna, 1975. 19 p.

Covers (1) Safety problems, considering transfer of know-how, technical aspects and human aspects of plant safety (2) Financial loss resulting from plant shutdowns (3) UNIDO's activities in the fertilizer sector, future programmes and suggestions for action.

ID/WG.221/7 + Summary — Special Refractory Materials for Use in Gas Reforming — E

By R.R. Miner
Vienna, 1975. 16 p. Tables, Diagrams, Illustrations.

Publication on industrial safety in ammonia plants, with special reference to the use of special refractory materials (alumina bubble products) in gas reforming. - (1) Reviews use of raw materials including: dense high alumina, fired; bubble high alumina , fired; dense sintered alumina; dense high alumina castable; bubble high alumina castable; ceramics fibre blanket (2) Discusses characteristics of each product and special areas of application (3) Covers tube and sheet protection. Process Statistics.

ID/WG.221/8 + Summary — Stress Corrosion Cracking in Ammonia Plants — E

By M.E.D. Turner
Vienna, 1975. 16 p. Diagrams, Illustrations.

Publication on industrial safety in ammonia plants, with special reference to the prevention of stress corrosion cracking (SCC) of equipment. - (1) Corrosion engineering (2) Implications of SCC in practice (3) Ammonia stress corrosion of brass (4) Chloride SC of austenitic stainless steel (5) Caustic soda cracking of carbon steel (6) Stress corrosion peculiar to ammonia plants (7) Carbon steel in liquid ammonia, etc. Bibliography.

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Language

ID/WG.221/9 — Explosion in Urea Fertilizer Factory Ghorasal. A Case History — E

By A. Huq, A.K.M.A Matin
Vienna, 1975. 10 p.

Publication on industrial safety for ammonia plants, presenting case study of an explosion at the ammonia control room at an urea plant in Bangladesh. - Covers (1) Fertilizer industry in Bangladesh (2) Condition of plant and equipment at the time of explosion (September 1974) (3) Probable causes, impact on the national economy, measures taken to prevent recurrence of such disasters.

ID/WG.221/10 + Summary — Safety Audits in Ammonia Plant Design — E

By E.W. Owen, P.M. Sales
Vienna, 1975. 30 p.

Covers (1) Basic principles of safe design (2) Specific design attitudes (3) Review techniques (4) Environmental aspects and pollution control (5) Reliability engineering design and techniques (6) Factory layout including communications (7) Choice of technology, process, machinery and equipment (8) Procurement (9) Feedback from site, problem reporting system, etc. Bibliography, Sample Problem Report.

ID/WG.221/11 + Summary — A Report on a Fire in the Ammonia Synthesis Unit — E

By M.L. Seth
Vienna, 1975. 10 p. Diagrams.

Presents report on a fire in the ammonia synthesis section of a 450 tons per day ammonia plant in India, covering occurrence, damage caused, observations made after the fire, probable causes, resulting modifications. Factory Layout, Equipment Diagrams.

ID/WG.221/12 + Summary — Instrumentation and Computer Control for Safe Ammonia Plants — E

By M. Nobue
Vienna, 1975. 38 p. Diagrams.

Publication on industrial safety in ammonia plants, with special reference to use of instrumentation and electronic data processing in process control. - (1) Describes process at a typical large scale plant using steam power (2) Gives outline of main instrumentation (3) Covers (A) steam system and trip system (B) application of computerized automatic control (principles, available computer programmes, prospects).

ID/WG.221/13 + Summary — Safety Consideration in the Operation and Maintenance of Ammonia Plants — E

By T.M. Das
Vienna, 1975. 110 p. Tables, Diagrams.

Covers (1) Ammonia process technology (2) Hazards, workers' safety and protective equipment (3) Power supply and power failures (4) Explosive mixtures and fire hazards (5) Air separation plants for oxygen gasification process; air cleaning (6) Catalysts (7) Process control, instruments, automatic trip systems, pressure relieving devices (8)Pollutants and pollution control (9) Corrosion control (10) Maintenance and repair, training, etc.

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		Language
ID/WG.221/14 + Summary	Centrifugal Compressors for Ammonia Plants. Design and Operation Considerations By W.A. Zech Vienna, 1975. 47 p. Diagrams, Graphs, Illustrations Covers (1) Fundamental design considerations for such standard equipment used in synthesis gas compression for ammonia production (2) Analytical tools at the designers' disposal, including electronic data processing (3) Merits of low pressure versus high pressure testing (4) Selection of compressors for typical ammonia plants (5) Serious operational problems and their prevention.	E
ID/WG.221/17	Madras Fertilizers Ltd. (India) - Case History of an Accident in the CO Removal System By T.R. Visvanthan Vienna, 1976. 3 p. Publication on industrial safety aspects of fertilizer industry in India. - Presents a case study of a failure in the carbon monoxide gas removal system of an ammonia plant, with reference to instruments, control valves, air cleaning.	E
ID/WG.221/18	Safety in the Design and Operating of Ammonia Plants By G.R. James, W. Fox, K.J. Stokes Vienna, 1976. 10 p. Covers (1) Some known incidents, their causes and remedial action (2) Characteristics of compound chemicals used; appropriate engineering design (3) Specifications for manufacture of ammonia from (a) natural gas (b) liquid or solid feedstocks.	E
ID/WG.221/19/ Rev.1	Safety in Design and Operation of IEL Ammonia Plants By K. Narayanan, R.B. Dutt Vienna, 1976. 13 p. Publication on industrial safety considerations in design and operation of ammonia plants in India. - Covers (1) Approach used at explosives and fertilizer plants, including: electrical classification of hazardous areas; special care in design and application of electrical equipment; automatic control instrumentation for process control (2) Reliability of protective devices, operational experience.	E
ID/WG.221/20	Turbines and Compressors for Ammonia Synthesis Plants By A.N. Venkatesen Vienna, 1976. 19 p. Covers: driving system, gas circuits, steam turbines, centrifugal compressors, lubrication; design of process control; safety valves; maintenance and repair.	E

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Language

ID/WG.221/21 — Safety Considerations for Design of Reformer Furnaces — E

By S.N. Nazir, R.N. Saran, G. Venugopal
Vienna, 1976. 19 p. Tables, Diagrams.

Covers (1) Steam reforming of hydrocarbons for manufacture of hydrogen and chemical synthesis gases (2) Importance of proper maintenance and repair (3) Engineering design, instruments and other equipment. Based on experience in India.

ID/WG.221/22 — Corrosion Problem in Air Separation Plant — E

By A.S. Chatha
Vienna, 1976. 6 p. Diagrams.

Publication on corrosion problems of a fertilizer industry (ammonia plant) in India. - Describes factory and equipment, identifying causes of trouble and referring to remedial measures to minimize corrosion. Additional reference: maintenance and repair, industrial safety.

ID/WG.221/23 — Corrosion Control in Ammonia Plants — E

By V.S. Pillai
Vienna, 1976. 15 p. Tables.

Covers (1) Steam power plants using residual oil from petroleum refineries; corrosion experienced in such furnace systems (2) Corrosion in cooling water (3) Cooling towers with contaminated water (4) Corrosion in CO2 removal systems. Based on experience in India. Statistics. Additional references: maintenance and repair, factory, industrial safety.

ID/WG.221/24 — Testing and Control of Service Deterioration in Ammonia Plants: Pipe-lines and Vessels — E

By C. Aravindakshan, K.C. Banerji, P.K. Ghosh, K.V. Sundaram
Vienna, 1976. 22 p. Tables.

Publication on maintenance and repair regarding pipes and vessels in ammonia plants. - Covers (1) Preventive maintenance and repair as against predictive maintenance (2) Commonly used techniques (3) Scope of testing of materials (4) Case histories (5) Gaps in technology. Based on experience in India. Statistics. Additional references: industrial safety, factory, process control, corrosion.

ID/WG.221/25 — A Case Study on Namrup Flue Gas Boiler Failure — E

By B.B. Chandra
Vienna, 1976. 15 p. Table.

Case study of a boiler's failure in an ammonia plant in India. - Covers (1) Ammonia plant based on steam reformation of natural gas; process description (2) Specifications of the flue gas boiler; failure; salient features of modifications and repairs (3) Modifications of instruments. Additional references: maintenance and repair, steam power, industrial safety, factory.

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Language

ID/WG.221/26 — Cormandel Fertilizers Ammonia Plant - A Case Study — E
By M.R. Krishniah
Vienna, 1976. 7 p. Diagrams.

Case study of problems in an ammonia plant in India. - Covers (1) Explosion in compressor discharge line (2) Failure of secondary reformer vessel wall. Additional references: maintenance and repair, process control, chemical reactors.

ID/WG.221/27 — A Case History of Surge Problems in Process Air Centrifugal Compressor at Indian Farmers Fertilizer Co-operative, Kalol, India — E
By L.R. Talwar
Vienna, 1976. 10 p. Diagrams, Graph.

Case study of equipment problems in a fertilizer industry (ammonia plant) in India. - Covers: compressor data; development of trouble; causes for surging; remedies and additional precautions. Additional references: maintenance and repair, water, equipment, industrial safety, process control.

ID/WG.221/28 — Catalysts in Ammonia Industry — E
By T.S. Nagarjunan
Vienna, 1976. 13 p.

Covers (1) Conditions for proper performance of the catalyst; controlling parameter; properties of catalyst surface; aging of catalysts (2) Types of catalysts; naphta desulphurization; primary reforming; shift; methanation; ammonia synthesis catalyst. Based on experience in India. Additional references: chemicals, sulphur.

ID/WG.221/29 — Design and Operation Problems of Compressor Systems in Ammonia Plants — E
By L. Laboratore
Vienna, 1976. 10 p.

Publication on industrial safety in ammonia plants, with special reference to compression systems. - Covers (1) Critical areas in engineering design and operation of ammonia synthesis turbo compressors (2) Design criteria for related auxiliary equipment (3) Integration of the machinery with the plant system (4) Process control and protective instruments. etc.

ID/WG.221/30 (ID/171) — Safety in the Design and Operation of Ammonia Plants. Report of a Meeting Sponsored Jointly by the UNIDO and the Fertilizer Association of India — E
Vienna, 1976. 41 p.

(1) Summarizes (A) issue papers and related discussions (B) country papers presented to the meeting (2) Gives list of documents. Recommendations.

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Preparatory Meeting for the First Consultation Meeting on the Fertilizer Industry
Vienna, Austria, 8 - 12 November 1976

		Language
ID/WG.236/1 (ICIS.20)	Review of the Draft World-Wide Study of the Fertilizer Industry: 1975 - 2000 Vienna, 1976. 17 p. Graph. Publication reviewing a global study of fertilizer industry prospects. - (1) Considers development potential of this sector and its economic implications for targets set by the Lima Declaration (2) Covers: fertilizer world consumption with projections for 1980 to 2000; world production; raw materials (phosphate rock, potash, coal, sulphur, natural gas, petroleum, ammonia, water, etc.); organic materials; marketing; location of industry; pollution control; national level and regional level policies (3) Suggests future action. Statistics.	E F S
ID/WG.236/2	Supporting Information on Eight Issues Which Might be Selected for Consideration at the Consultation Meeting (on Fertilizer Industry, 1976) Vienna, 1976. 42 p. Tables, Graphs Covers (1) Potential growth of world production and world consumption of fertilizers to year 2000 (2) Future distribution of production between developed countries and developing countries; constructing factories in DC's; utilization of production capacities; required financing; prices stability; alternatives for DC's with small domestic markets; organic fertilizers; employment aspects. Statistics.	E F S

First Consultation Meeting on the Fertilizer Industry
Vienna, Austria, 7 - 11 February 1977

ID/WG.242/2	Issues to be Considered by the Consultation Meeting on the Fertilizer Industry Vienna, 1976. 9 p. Covers (1) The allocation of fertilizer production between developing countries and developed countries; and among DC's (2) Infrastructure needed in DC's for production and distribution (3) The construction and operation of fertilizer factories; methods to insure effective technology transfer and supply of machinery and use of existing and new production capacity (4) Financing of plants and related infrastructure.	E F S R

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		Language
ID/WG.242/6	The Status of Development of the Fertilizer Industry in Indonesia Published in co-operation with Ministry of Industry, Indonesia Vienna, 1977. 7 p. Maps. Covers (1) Current status, plans and development potential of the industry (2) Priorities, production capacities. Industrial projects under way, urea production based on natural gas feedstocks, diversification (3) Fertilizer distribution; transport problems (4) ASEAN regional co-operation, multinational projects (5) Prospects.	E
ID/WG.242/7	Fertilizer Situation in Thailand By M.C. Piriyadis Diskul Vienna, 1977. 4 p. Covers agriculture, fertilizer use (presently low); government efforts at promotion of related industrial projects based on available indigenous raw materials; phosphate exploration; technical assistance needs; regional co-operation within ASEAN, etc.	E
ID/WG.242/8/ Rev. 1	Report of the First Consultation Meeting on the Fertilizer Industry Vienna, 1977. 38 p. (1) Covers background and organization of the meeting (2) Gives conclusions regarding (A) growth of the developing countries' share of fertilizer world production 1975 to 2000; other objectives (B) infrastructure (C) the construction of fertilizer plants, establishment of new industry (D) the operation of plants, analysing major reasons for inefficiency (E) technical assistance. Role of UNIDO (F) financing of plants (G) regional co-operation. Recommendations. List of Participants.	E F S R C
	Meeting with Non-Governmental Organizations Having Consultative Status with UNIDO on Co-operation between these Organizations and UNIDO Vienna, Austria, 24 - 25 May 1977	
ID/WG.249/10	Development of the Fertilizer Industry in the Arab States Published in co-operation with the Arab Federation of Chemical Fertilizer Producers Vienna, 1977. 4 p. Covers formation and functions of the 'Arab Federation of Chemical Fertilizer Producers' (non-governmental organizations), outlining activities in the fields of studies, seminars, training, publications, and considering development potential of the industry in the Arab world. Reference: regional co-operation.	E

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Technical Seminar on Contracting Methods and Insurance Schemes for Fertilizer and Chemical Process Industries
Lahore, Pakistan, 25 - 29 November 1977

		Language
ID/WG.259/4	Legal Aspects of Contracts for the Successful Construction, Operation and Maintenance of Large Fertilizer and Chemical Processing Plants By D. Subramaniam Vienna, 1977, 71 p. (1) Covers (A) current legal practices in international contracts; scope, safeguards, dispute settlement, insurance coverage (B) legal means and methods for improvements of practices (C) establishment of a multilateral insurance scheme to cover consequential losses (2) Lists available model forms of contracts. Recommendations.	E
ID/WG.259/5	Insurance Cover Available from Commercial Sources Relating to the Construction and Initial Operation of Fertilizer Plants Published in co-operation with Hogg Robinson and Gardner Mountain Reinsurance Limited Vienna, 1977. 67 p. Covers (1) Existing forms of insurance cover available from commercial sources for direct physical loss or damage, consequential financial losses, etc. (2) Extension of Insurance to loss of profits resulting from inadequate performance of a plant (3) Costs estimates for specific forms of insurance policy covering p.e. an ammonia and urea plant, appending draft wording for six types of policy.	E
ID/WG.259/6	A Proposal for an Improved Plant Acceptance Testrun Schedule to Meet Contractual Guarantees Vienna, 1977. 10 p. Covers (1) Customary guarantees by contractors (2) Mechanical equipment acceptance testruns (3) Performance test guarantees with respect to: production capacity; efficiency or yield (productivity, equipment output ratio); raw material and catalyst consumption; product quality standards; power consumption; environmental engineering, pollution control (4) Proposed test programme.	E
ID/WG.259/7	Experience of Insurance in India By V.S. Pillai Vienna, 1977. 5 p. Publication on experience of insurance for fertilizer industry in India. - Covers: fire risk, machinery breakdown insurance; loss of property; comprehensive scheme for covering production loss due to fire or accident; premium rebate; examples of compensation allowed.	E

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Language

ID/WG.259/8 Summary of Four Papers Prepared for UNIDO on Contracts and Insurance for Fertilizer Plants — E
Vienna, 1977. 18 p. Table.

Publication giving a summary of four papers dealing with contracts and insurance for fertilizer industry and indicating problems meriting further examination prior to Second Consultation Meeting on the Fertilizer Industry. Statistics.

ID/WG.259/9 Comprehensive Outline on Contracting Methods — E
By I. Tatar
Vienna, 1977. 28 p.

Publication on contracting methods for factory establishment. - Covers (1) Importance of preinvestment study (2) Different types of contracts (3) Contract preparation to include specifications of prices, raw materials, infrastructure, etc. (4) Financial aspects and payment conditions; guarantee and penalty clauses; factory commissioning procedures; insurance, spare parts; training of technical personnel. Additional references: technology transfer, chemical industry.

ID/WG.259/10 Legal Aspects of Contracting Methods and Arbitration — E
By K. Czeija
Vienna, 1977. 25 p.

Publication on legal aspects of contracting methods and dispute settlement in factory establishment. - Covers (1) Outline of contract procedures between contractor and purchaser in developing countries (2) Case study of dispute and arbitration (3) Model formulation of contract clauses of importance; arbitration procedures and costs; legal assistance; conciliation committee. Bibliography. Additional references: technology transfer, chemical industry.

ID/WG.259/11 Technical Seminar on Contracting Methods and Insurance Schemes for Fertilizer and Chemical Process Industries — E
By I. Varkey
Vienna, 1977. 22 p.

Publication on contracting for factory establishment in chemical industry, with special reference to provision of insurance schemes for compensation for consequential losses. - Covers insurance schemes for risks and losses (a) prior to commissioning a plant (b) after plant is handed over. Annexes model insurance scheme covering most requirements.

ID/WG.259/12 Pre-Contracting Procedures for Fertilizer and Chemical Process Plants — E
Published in co-operation with National Design and Industrial Services Corporation, Pakistan; Vienna 1977. 1 vol. (various pagings). Tables.

Covers (1) Methodology suggested for public sector contracts preceded by accurate feasibility study (2) Type of contract, bid notices and documents, guarantees and penalties, indicative costs, bid evaluation, payment terms, negotiations, value judgement methods, capital costs, prices (3) Detailed services to be provided by (a) contractor supplying total plant (b) by engineering contractor.

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Language

ID/WG.259/13 Contracting Guidelines for Fertilizer and Chemical Plants E
Published in co-operation with the National Fertilizer Corporation of Pakistan
Vienna, 1977. 14 p.

Publication giving contracting guidelines for fertilizer industry and chemical industry, based on experience in Pakistan. - Covers contractors' and client's responsibilities, prices, terms of payment, guarantees, tests and penalties, taxes, force majeure, conciliation, arbitration, dispute settlement, termination of contract.

ID/WG.259/14 Performance Guarantees and Test E
By W.M. Butt, A. Shahnawaz
Vienna, 1977. 15 p. Tables.

Publication on performance guarantees and tests in contracting for chemical industry. - Covers (1) Criteria for effectiveness of plants (a) efficiency (b) low production costs (c) low capital costs (2) Guarantees for factory establishment involving programme of work, penalty and bonuses, construction schedules, project cost control, reimbursable contract, quality, performance tests, raw materials, engineering design.

ID/WG.259/15 Typical Contract for Chemical and Fertilizer Plants E
Vienna, 1977. 35 p.

Publication containing sample contract for factory establishment in the chemical industry. - Includes 21 articles referring i.a. to scope of work, conditions, equipment, licenses and technical information, prices, insurance, performance tests and dispute settlement.

ID/WG.259/16 Experience in Contracting for Fertilizer and Chemical Plants in Pakistan E
Published in co-operation with Pakistan Board of Industrial Management
Vienna, 1977. 29 p. Tables.

Covers (1) Various types of contracts, their problem areas; guarantees, arbitration, scope of consultant engineer's work, subcontracting (2) Case studies. Additional references: sulphuric acid, caustic soda, coal, gypsum, ammonium sulphate, urea, natural gas, ammonium nitrate, nitric acid, ammonia.

ID/WG.259/17 Peru. Contracting Methods and Insurance Schemes for Fertilizer and Chemical Process Industries E
By R. Berninzon
Vienna, 1977. 4 p.

Publication on contracting for purchase of equipment for fertilizer industry in Peru. - (1) Presents a case study of equipment replacement required after corrosion of steel pipes in condenser of a steam power plant (2) Advocates training programmes and technical assistance for developing countries in preparation of contracts including insurance guarantees.

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Language

ID/WG.259/18 Country Paper of Afghanistan (Fertilizer Industry) E
By A. Olomi
Vienna, 1977. 4 p.

Publication on contracting for installation of fertilizer industry in Afghanistan. - Covers general practices for factory establishment including provisions for insurance, dispute settlement, supply of spare parts for maintenance and repair.

ID/WG.259/19 Project Implementation and Contracting for Fertilizer Factories in India E
By T.R. Ardhanari
Vienna, 1977. 15 p. Diagrams.

Covers (1) Different contract schemes depending on extent of domestic content in factory establishment (2) Specifications of respective responsibilities (3) Relative advantages of turn key and joint execution arrangements.

ID/WG.259/20 Contracting Methods and Insurance for Fertilizer. Indonesia Country Paper E
Vienna, 1977. 4 p.

Covers (1) Plants existing and under construction producing urea, ammonium sulphate, ammonia, phosphate (2) Procedures followed for contracts and insurance schemes. Additional references: public enterprises, factory establishment.

ID/WG.259/21 Evaluation of Risks in Tender Preparation E
By T.M. Evans
Vienna, 1978. 16 p.

Publication on contracting methods for fertilizer industry, with special reference to risk evaluation in tender preparation. - Covers (1) Tendering objectives; definition of responsibilities; methods of tender pricing (2) Evaluation of risk factors (pricing of work, time factor, guarantees and liabilities, payment methods, bonds; changes, termination or suspension of work; insurance; patents)(3) Factors peculiar to export contracts.

ID/WG.259/22 UNIDO/BIM Seminar - Lahore. The Contractor's View of Consequential Liability E
By D. Glenton
Vienna, 1977. 10 p.

Publication on contracting methods and insurance schemes for factory establishment in chemical industry. - Covers (1) Unwillingness of contractors to accept liability for consequential losses; risks run by purchaser under various types of contract; risks run by contractor (2) Incentives to the contractor to fulfil obligations; negative incentives (penalties) (3) Need for most careful project design and planning (4) Insurance packages; dispute settlement.

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		Language
ID/WG.259/23	Agreement for Fertilizer Project. Co-operative Project View By V.R. Boharapurkar Vienna, 1977. 8 p. Publication on steps and issues in contracting for establishment of a fertilizer industry , based on experience in India. - Covers the basic agreement for the engineering services of consultant; invitation to bid, accompanied by draft agreement; standardized agreement clauses; taxation problems, etc. Additional reference: factory establishment.	E
ID/WG.259/24	Some Observations on Contract Conditions for Projects in Developing Countries By A. Brown Vienna, 1978. 7 p. Covers (1) Problem areas between project authorities and contractors, considering principal restraints to prompt project implementation (2) Responsibilities of project authority in pre-contract stage (3) Terms and conditions for foreign skilled personnel; facilities required, etc.	E
ID/WG.259/25	Experience of Engineers India Ltd. in Contracting Methods By U.R.W. Pande Vienna, 1977. 10 p. Covers (1) Principal activities of public sector, firm concerning technology services in the field of petrochemicals and fertilizers (2) Types of contracts (a) cost reimbursable (b) fixed price; guarantees. Additional reference: factory establishment.	E
ID/WG.259/26/ Rev.2	Report (Seminar on Contracting and Insurance for Fertilizer and Chemical Process Industries) Vienna, 1978. 37 p. (1) Gives summaries of papers relating to experience in Pakistan, Peru, Afghanistan, India and Indonesia (2) Covers (A) pre-contracting steps and different types of contracts (B) guarantees and penalties (C) dispute settlement, arbitration, insurance, model contracts. Recommendations, List of Participants.	E

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FAI-IFDC Fertilizer Seminar 1977 on Trends in Consumption and Production
New Delhi, India, 1 - 3 December 1977

Language

IOD. 120 — Issues Facing the World Fertilizer Industry — E
By M.C. Verghese
Vienna, 1977. 51 p. Tables, Graphs, Diagrams.

Covers: Need to increase food production and nutritional standards; infrastructure; delays in factory construction; full utilization of existing production capacities (water, power supply, manpower); contracting; rising raw material and capital costs; financing; cyclical world prices; alternative raw materials, advanced technologies; pollution control; technology transfer; regional co-operation. Statistics, Bibliography.

Expert Group Meeting on Regional Co-operation among Developing Countries in the Fertilizer Industry
Vienna, Austria, 8 - 10 February 1978

ID/WG.265/1 — Regional Co-operation in the Fertilizer Industry: The Experience and Potential of the ANDEAN Group of Countries — E
By P. Castro
Vienna, 1978. 19 p. Tables.

Covers (1) Experiences within the ANDEAN Group (fertilizer programme and model, proposals, joint ventures, financial aid) (2) Experiences involving (A) other Latin American countries (SELA, Bolivia, Brazil) (B) Colombia, Venezuela and Netherlands; Peru and Spain (3) Potential fields of co-operation, including information exchange, financing, tariff policy. Appends JUNAC background papers. Statistics.

ID/WG.265/2 — Co-operation in the Fertilizer Industry: The Experience of the Arab Federation of Chemical Fertilizer Producers — E
By W.D. Kelada
Vienna, 1978. 13 p. Tables.

(1) Reviews development and prospects of the industry, listing plants, fertilizer products and export potential (2) Covers (A) establishment of the 'Arab Federation of Chemical Fertilizer Producers', its activities relating to production problems, information exchange, technical studies, training, meetings, documentation, etc. (B) future co-operation among Arab and other developing countries. Statistics.

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Language

ID/WG.265/3 Co-operation Amongst Developing Countries in the Fertilizer Industry: The Experience of Pakistan as Regards Financing Two Fertilizer Plants — E
By F.S. Aijazuddin
Vienna, 1978. 4 p. Tables.

Covers 'Paksaudi' and 'Pakarab' projects, outlining background of establishment, with attention to capital costs, foreign exchange financing, technology transfer, contractors and consultants. Reference: regional co-operation, role of developing countries. Statistics.

ID/WG.265/4 Regional Co-operation in the Fertilizer Industry: Experience and Opportunities in Latin America — E
By E. Gutierrez-Salgado
Vienna, 1978. 19 p. Tables.

Covers (1) Fertilizer use and production (phosphate, nitrogen, potash); dependence on imports; effect of high prices (2) Present form and mechanism for co-operation in Latin America, mentioning experience of LAFTA, ADIFAL and SELA (3) Opportunities for increased co-operation, within and outside the region. Annexes statistics on fertilizer world consumption and Latin American production capacity and supply capability.

ID/WG.265/5 The Potential for Co-operation in the Nitrogen Fertilizer Industry in Latin America — E
By E. Gutierrez-Salgado
Vienna, 1978. 16 p. Tables.

Covers (1) Raw materials and feedstocks (2) World production capacity of anhydrous ammonia; consumption and demand (3) Current and future situation; projections, planning for additional capacity; export capacity, etc. Statistics.

ID/WG.265/6 Bilateral and Regional Co-operation Among Developing Countries in the Fertilizer Industry. Experience of India — E
By S.K. Mukherjee
Vienna, 1978. 35 p. Tables.

Covers (1) Growth of the industry (production capacity, feedstocks, phosphate fertilizer, self help) (2)Bilateral relations with Iran, Sri Lanka, Bulgaria, Kuwait, Bahrain, United Arab Emirates, Iraq, Egypt, Philippines, Brazil, Turkey, Burma, Tanzania, Libya, Zaire, Syria, Yemen PDR., ANDEAN Group countries (3) Equipment manufacture and factory construction in India. Statistics.

ID/WG.265/7 Suggested Areas of Co-operation Among Developing Countries in the Fertilizer Industry — E
Vienna, 1978. 10 p. Tables.

Covers (1) Suggested co-operation in (A) production of fertilizer intermediates and raw materials (B) promoting trade in these materials among DC's (C) in factory construction with a view to increasing production capacity (2) Institutional framework and arrangements required to implement co-operation (3) Nitrogen and phosphate fertilizer world production and supply and demand. Statistics.

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Language

ID/WG.265/8 Posibilidades de Integración en el Sector Fertilizantes del Grupe Andino. Algunos Trabajos de JUNAC al Respecto — S
By R. Donso
Vienna, 1978. 17 p. Tables.

Publication on regional co-operation in the field of fertilizer industry, with special reference to the ANDEAN Group. Covers (1) Past and projected future (1989) use and production of fertilizers in Bolivia, Colombia, Ecuador, Peru and Venezuela (2) Plants producing ammonium nitrate, phosphates, potash (3) Joint study of sector to discover most favourable conditions for production and commercialization of fertilizers in sub-region (4) Required trade liberalization, information exchange, co-operation. Statistics. Additional references: transport, costs.

ID/WG.265/9 Investment Planning in the Fertilizer Industry: Research and Applications at the World Bank — E
By A. Meeraus
Vienna, 1978. 14 p.

Covers (1) Scope and objectives of long term research programmes at the World Bank; results achieved during research phase; application of planning method under operational conditions (2) Progress made in using planning models for sector and industrial project planning, referring to East Africa, global level model, Egypt, ASEAN and India. Bibliography.

ID/WG.265/10 Posibilidades de Desarrollo de la Industria de Fertilizantes en Centroamerica — S
By A. Guerra-Borges
Vienna, 1978. 6 p.

Covers (1) Consumption between 1961 and 1976 (2) Types of fertilizers preferred (3) Principal production firm FERTICA with factories in Costa Rica, El Salvador, Guatemala (4) Considerations affecting future demand within CACM and potential increase of production (5) Location of industries, transport aspects, prices. Additional references: Honduras, Nicaragua.

ID/WG.265/11/ Rev. 1 Report (Meeting on Regional Co-operation Among Developing Countries in the Fertilizer Industry) — E F S
Vienna, 1978. 24 p. Tables.

Covers (1) Co-operation in (A) production of fertilizers, intermediates and raw materials (B) trade policy and promotion among DC's (C) construction and operation of factories (D) arrangement of institutional framework favouring co-operation (2) Global level supply and demand in nitrogen and phosphate fertilizer industry and in potash. Statistics, List of Documents, List of Participants.

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First Working Group on Contracts and Insurance for Fertilizer Plants
Vienna, Austria, 14 - 17 February 1978

		Language
ID/WG.269/1	Some Practical Implications of Establishing a Multilateral Insurance Scheme to Cover Consequential Losses that arise due to the Inadequate Performance of Fertilizer Plants and Specific Items of Equipment Vienna, 1978. 13 p. Covers (1) Causes that might be covered (2) Measuring consequential losses (3) Insurance cover available commercially; a proposed multilateral scheme; possible need for Government assistance (4) Alternatives involving public financing and credit insurance organization, etc. (5) Contracts giving better protection to all parties.	E F S
ID/WG.269/2/ Rev. 1 + Corr. 1	Report (Working Group on Contracts and Insurance for Fertilizer Plants) Vienna, 1978. 22 p. Summarizes discussions on: risk coverage; consequential financial losses and their compensation; insurance by commercial sources; government support for insurance schemes; draft contract clauses, etc. Recommendations, List of Participants, List of Documents, UNIDO Questionnaire.	E F S E

Arab Federation of Chemical Fertilizer Producers (AFCFP)/ UNIDO Seminar on Raising Productivity of Fertilizer Plants
Baghdad, Iraq, 24 - 27 March 1978

ID/WG.270/1	Utilities Supply, Off-site Facilities and Technical Infrastructure for Efficient Operation of Fertilizer Plants By W.M. Butt Vienna, 1978. 58 p. Tables, Graphs, Diagrams. Publication on technical requirements for efficient operation of fertilizer industry plants. - (1) Outlines issues (2) Covers (A) power supply, cooling water steam power, water supply and water treatment, instruments, air cleaning, storage facilities, electric power, maintenance and repair, spare parts supply (B) emergency situations, industrial safety (C) environmental engineering, pollution control (D) economic aspects. Bibliography, Statistics, Flow Charts.	E

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Language

ID/WG.270/2 — Technical Manpower Development — E
By V.R. Vangala
Vienna, 1978. 54 p. Tables, Diagrams.

Publication on training for technical personnel for fertilizer industry. - Covers: manpower and management development as a factor of productivity; organization of in-plant training; employment policy relating to new plants; optimal staffing scheme; social aspects of manpower development; raising labour productivity; training programmes, giving case studies (Egypt, India); role of UNIDO. Includes manning table for foreign skilled personnel for an ammonia-urea plant.

First Meeting of the Working Group on Model Contracts for Fertilizer Plants
Vienna, Austria, 10 April 1978

EX. 40 — Report of the Meeting — E
Vienna, 1978. 8 p.

(1) Covers background and purpose of the meeting
(2) Presents a check list of main articles of model contracts and a list of annexures to the main commercial contract (for discussion at future meetings).

Expert Group Meeting on Fertilizer Plant Cost Reduction and Ways to Mobilize Sufficient Financing
Vienna, Austria, 11 - 14 April 1978

ID/WG.274/4 — Ways and Means to Reduce the Cost of Fertilizer Plants to be Built in Developing Countries — E
By V.S. Pillai
Vienna, 1978. 53 p. Tables.

Covers: cost rise in plants since 1970 and influence on infrastructure; capital structure, capital investment, working capital; feasibility study, location of industry; clear specifications; bidding and evaluation; avoidance of project delays; standardization for ammonia plants; the role of developing countries in co-operation for technology transfer; customs policy; barge-mounted units. Statistics.

ID/WG.274/5 — Some Aspects on Ways and Means to Reduce Fertilizer Plant Costs and to Mobilize Sufficient Financing — E
Vienna, 1978. 8 p.

Covers (1) Infrastructure components costs; capital costs; requirements for typical ammonia and urea plants (2) Proposals to reduce costs, referring to: location of industry; clear specifications for international bidding; consulting; standardized building design and factory layout; engineering costs for similar plants; tax exemption for import of equipment; possible use of barge delivery (3) Source of funds, joint ventures, international co-operation, role of international organizations, TCDC. Recommendations, Statistics.

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Language

ID/WG.274/6 — Reduce Costs by Planning the Overall Project — E
By D. Elliott, I.G. Hirst
Vienna, 1978. 15 p. Diagram.

Publication on project design and planning as a factor in reducing costs in the fertilizer industry. - Covers: project conception and management, role of the project manager; fundamental steps, feasibility study, contract award, project implementation, operation, role of consultant, etc. Appends flow chart for an industrial project.

ID/WG.274/7 — Suggestions for Increasing Standardization of Ammonia Plant Capacities and Equipment — E
By F.C. Brown
Vienna, 1978. 11 p.

Publication on costs reduction for fertilizer industry, with special reference to standardization of ammonia plant capacities and equipment. - Covers: standardizing process and engineering design; plot areas and pipe standards; specifications for vessels (boilers) and heat recovery; electrical equipment and instruments; mechanical equipment; reducing maintenance and repair and production costs; environmental engineering, industrial safety, pollution control; flowsheet conditions; role of UNIDO.

ID/WG.274/8 — Cost of Fertilizer Plants in Spain, South America and the Middle East — E S
By L.M. Marzo
Vienna, 1978. 7 p. Tables.

Publication on comparative costs of fertilizer industry plants in Spain, South America and the Middle East. - Provides up-to-date figures on costs within battery limits for plants producing various fertilizers and phosphoric acid and sulphuric acid. Reference: production capacities. Statistics.

ID/WG.274/9 — Reduction in Investment and Operating Costs Achieved through the Use of New Ammoniation Systems — E S
By J. De Mingo, F. Pollastrini
Vienna, 1978. 12 p.

Covers: choice of technology for granulation process; the slurry process; simplification of ammoniation system, the pipe chemical reactors, industrial application at specific plant; production costs, investment, equipment costs. Process flow charts.

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Language

ID/WG.274/10 — The Effect of Proper Project Management on Reducing Costs for Fertilizer Plants — E

By P.V. Clifton
Vienna, 1978. 10 p. Tables, Graph.

Covers (1) Ways and means to reduce capital costs for short-term and medium-term, considering especially production of ammonia and urea in integrated factories (2) Investment, financing, prices, industrial project parameters (3) Factors to be considered by project manager for successful establishment of new industry in this field. Statistics.

ID/WG.274/11 — The Mobilization of Finance for the Construction of Fertilizer Plants in the Developing Countries — E

By J. White
Vienna, 1978. 4 p.

Outlines issues involved, formulating some relevant questions. Reference: establishment of new industry, loans, source of funds.

ID/WG.274/12 — Some Suggestions for Reducing Investment Costs and Mobilizing Sources of Financing for Fertilizer Plants - Experience of Romania in this Field — E F

By N. Popovici
Vienna, 1978. 15 p. Tables, Diagram.

Covers: choice of technology, location of industry, production capacity of the units; standardization of installations; participation of nationals in construction; technology transfer; degree of automation; optimum pollution control; financing. Reference: capital costs.

ID/WG.274/13 — Means to Reduce Costs of Fertilizer Plants - An Egyptian Case History — E

By A.R. Shoukry
Vienna, 1978. 13 p. Tables.

(1) Presents case study of the 'Helwan' nitrogen fertilizer project, itemizing investment costs (2) Identifies seven components constituting fixed capital costs and working capital requirements and outlines ways toward reduction of capital costs. Reference: site assessment, factory building design and construction, machinery and equipment costs, choice of technology. Statistics.

ID/WG.274/14 — Increase in Cost of Building an Ammonia Plant since 1970 — E

In co-operation with Centre d'Etude de l'Azote, Zuerich
Vienna, 1978. 6 p. Tables, Graphs.

Presents information, indices and some conclusions based on relevant experience in Italy, Netherlands, UK and Germany, FR. Statistics.

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Language

ID/WG.274/15 — Possibilities of Reduction of Investment in Fertilizer Projects in Developing Countries — E

By R.R. Poricha
Vienna, 1978. 45 p. Tables.

(1) Examines capital structure of some nitrogen fertilizer plants in India, attempting to isolate various cost centres and investigate their effect on total investment (2) Covers possibilities of cost reduction in future projects (3) Presents case studies and conclusions relevant also to phosphate fertilizer industry. Reference: tax and customs policy, license, engineering, procurement charges, financing modes, prices, contracts, equipment. Statistics.

ID/WG.274/16 — Reducing the Cost of Fertilizer Plants in Developing Countries — E F

By A. Ben Youssef, M. Sellami
Vienna, 1978. 5 p.

Covers factors in reducing capital investment costs, with special reference to (1) Location of industry taking advantage of state-provided infrastructure (2) Provision of precise project information in invitations to tender.

ID/WG.274/17/ Rev. 1 — Report (Meeting on Fertilizer Plant Cost Reduction and Financing) — E F S

Vienna, 1978. 22 p.

Summarizes discussion and gives conclusions with regard to (1) Increase in the capital costs of fertilizer plants; trends (2) Ways and means to reduce investment costs (3) Financing of plants; foreign exchange component; loan policy of banks. Reference: IBRD, CMEA. Statistics, Recommendations, List of Documents.

Second Meeting of the Working Group on Model Contracts for Fertilizer Plants
Vienna, Austria, 19 - 23 June 1978

EX. 45 — Report of the Meeting — E

Vienna, 1978. 17 p.

(1) Covers harmonization of approaches regarding contents and terminology of model forms of contract (2) Annexes i.a. lists of main articles and technical annexures of contract; additional clauses; suggested outline of guidelines for use. List of Participants.

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Second Consultation Meeting on the Fertilizer Industry
Innsbruck, Austria, 6 - 10 November 1978

		Language
ID/WG.281/1	Model Forms of Contract for the Construction of a Fertilizer Plant and Guidelines for their Use. Training of Personnel for Start-up and Operation of a New Fertilizer Plant By P.T. Pupuk Sriwidjaja Vienna, 1978. 24 p. Tables, Diagrams. Covers: organizational aspects of staffing; recruitment training of technical personnel by contractor; training opportunities in developed countries; training abroad; co-operation: role of developing countries. Reference: Training centres, training programmes, project implementation. Manning table, Statistics.	E
ID/WG.281/2	The Preparation by UNIDO of Model Forms of Contract for the Construction of a Fertilizer Plant and Guidelines for their Use Vienna, 1978. 17 p. (1) Covers: follow-up activities recommended by previous meeting; need for model forms; role of UNIDO in their preparation; guidelines for their use; relevant working group; features of the UNIDO draft forms on which international agreement could be reached; approach for finalization. (2) Annexes (A) uniform list of articles included in model forms (B) checklist of technical annexures to contract. Reference: factory, technology transfer.	E F S R C
ID/WG.281/3	FAO Fertilizer Activities Vienna, 1978. 12 p. Covers: promotion of fertilizer use; programme, projects, training; international supply scheme (IFS); improvement of distribution and credit networks; economic aspects of use; FAO information service, electronic data processing; monitoring supply, demand and prices; international policy issues; environmental problems, pollution control; fertilizer use in forestry and aquaculture fishery. Reference: fertilizer industry, international organizations.	E
ID/WG.281/4	Opportunities for Co-operation Amongst Developing Countries in the Fertilizer Industry Vienna, 1978. 29 p. Covers (1) Importance of fertilizers for agriculture of DC's (2) Co-operation (A) to utilize excess capacity (B) in setting up new factories and planning of new industrial projects (C) in setting up training centres (E) in distribution of fertilizers (3) Co-operation contracts: problems, formulation, benefits (4) The role of UNIDO and other international organizations. Reference: transnational corporations. List of Documents.	E F S

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		Language
ID/WG.281/5 + Corr. 1	Infrastructure Required for the Production and Distribution of Fertilizers Vienna, 1978. 53 p. Tables. Covers: the estimated investment costs of establishing items of infrastructure; the demarcation of responsibility for establishing such infrastructure between the government and the fertilizer producing enterprise; terms appropriate for financing such infrastructure investments. Reference: government policy, training, storage, transport, social aspects, case studies, developing countries.	E F S R C E
ID/WG.281/8	Demarcation of Responsibility for Establishing the Infrastructure Required for the Production and Distribution of Fertilizers. Issue Paper Vienna, 1978. 14 p. Covers (1) Identification of items of infrastructure required and their estimated investment costs (2) Demarcation of responsibility for establishing and financing infrastructure for (A) a fertilizer factory (B) distribution (3) Arrangements and terms and conditions appropriate for financing (4) Guidelines on which international agreement might be reached at consultation meeting. Additional references: public financing, loans, establishment of new industry.	E F S R C
ID/WG.281/9	Regional Co-operation Amongst Developing Countries in the Fertilizer Industry. Opportunities in LDC's to Establish Facilities for the Production and Distribution of Fertilizers and the International Co-operation Required Vienna, 1978. 14 p. Tables. (1) Summarizes results of a survey of investment opportunities for establishment of facilities for bulk-blending and bagging or production of fertilizers in 23 LDC's of Africa, Middle East and Asia (2) Covers: trends in fertilizer use; sources of supply; high costs of delivery to farmers (distribution); investment opportunities, capital investment required. Additional references: phosphate, nitrogen. Statistics.	E F S
ID/WG.281/10	Investment and Production Cost of Fertilizers By W.F. Sheldrick Vienna, 1978. 21 p. Tables. (1) Indicates, for a range of operating conditions and locations, the effect of such costs in establishment of new industry on future prices of some nitrogenous and phosphate fertilizers (2) Covers manufacture of (A) urea (B) phosphoric acid and triplephosphate. Additional references: IBRD, estimating, capital costs, comparative costs, ammonia, sulphur, natural gas. Statistics.	E

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		Language
ID/WG.281/11	Arrangements for Meeting to Promote the Establishment of Fertilizer Plants in Developing Countries Vienna, 1978. 2 p. Aide Mémoire for a meeting on fertilizer industry, with special reference to relevant establishment of new industry in developing countries.	E F S R
ID/WG.281/12 + Add. 1 + Corr. 1	Preliminary Draft of the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant In co-operation with National Design and Industrial Services Corp., Lahore, Pakistan Vienna, 1978. 120 p. (1) Provides 46 contract articles (2) Covers (in a separate Addendum) technical aspects and specifications for an ammonia-urea complex based on natural gas. Background references: establishment of new industry, models.	E F S R
ID/WG.281/13 + Corr. 1	The Progress Made in Implementing the Follow-up Action Recommended by the First Consultation Meeting. Issue Paper Vienna, 1978. 34 p. Table. Covers (1) Follow-up action recommended (2) Progress in the areas of (A) contract procedures (B) a multilateral insurance scheme (C) costs reduction for fertilizer factories (D) monitoring of growth of production capacities (E) regional co-operation, role of developing countries (F) infrastructure; information services, INTIB; relevant experience in establishment of new industry; industrial consulting. List of Documents. Statistics.	E F S R C E
ID/WG.281/14 + Summary	Continuous Monitoring of the Growth of Fertilizer Capacity at the National, Regional and Global Levels in order to Facilitate a Balanced Growth of the World Fertilizer Industry Vienna, 1978. 44 p. Tables. Covers demand, supply and production capacity for fertilizers at the global level, regional level and national level, considering nitrogen, phosphate (phosphoric acid) and potash products, with reference to the medium term, short term and long term prospects. Additional references: world production, world consumption, forecast, developing countries. Statistics.	E F S

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		Language
ID/WG.281/17	Report of Working Group on Infrastructure for the Production and Distribution of Fertilizers Vienna, 1978. 7 p. Tables. Publication on financing of infrastructure required in establishment of fertilizer industry in developing countries. - Contains (1) Report of a working group set up to consider and formulate relevant guidelines for the Second Consultation Meeting on the industry (2) Text of guidelines and recommendations concerning (A) demarcation of related responsibilities (B) financing (3) Outline of infrastructure requirements. Additional references: establishment of new industry, public financing, distribution.	E F S R
ID/WG.281/18/ Rev.1 (ID/221)	Report (Consultation on Fertilizer Industry) Vienna, 1978. 60 p. Covers (1) Relevant role of UNIDO; progress made since First Consultation Meeting (2) Activities of FAO, IBRD and other international organizations (3) Topics for further examination by UNIDO (4) Infrastructure for production and distribution of fertilizers (5) Role of developing countries in co-operation (6) Model forms of contract for factory construction. Additional references: least developed countries, technical assistance. List of Participants, List of Documents.	E F S R
ID/WG.281/19	Report of the Working Group on Regional Co-operation Between Developing Countries in the Fertilizer Industry Vienna, 1978. 8 p. Covers (1) Background to co-operation (2) The role of UNIDO in strengthening co-operation between developing countries (3) Recommendations regarding a programme for immediate action including establishment of an *ad hoc* committee.	E F S R
ID/WG.281/20 + Add. 1	Report of the Working Group on the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant Vienna, 1978. 11 p. Contains (1) Summary of discussions; conclusions and recommendations of the Working Group (2) Proposed modifications to the model form of the contract.	E F S R E
ID/WG.281/ CRP.2	Preliminary Draft of the Model Form of Turn-Key Lump-Sum Contract for the Construction of a Fertilizer Plant Vienna, 1978. 173 p. Contains (1) 46 articles of the contract (2) Technical annexures prepared for an ammonia-urea complex based on natural gas. Background references: establishment of new industry.	E

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Language

ID/WG.281/CRP.5 — Summary Table of Infrastructure Requirements for 18 Fertilizer Projects Appraised by the World Bank — E

By C.J. Pratt
Vienna, 1978. 2 p. Tables.

Summary table of infrastructure requirements for eighteen fertilizer industry projects appraised by the IBRD. Statistics.

International Forum on Appropriate Industrial Technology
New Delhi/Anand, India, 20 - 30 November 1978

ID/WG.282/16 — The Fertilizer Industry. Background Paper — E

Working Group No. 1 - Appropriate technology for heavy industries.
By M.C. Verghese
Vienna, 1978. 20 p.

Publication on appropriate technology regarding fertilizer industry. - Covers (1) 'Jumbo' plants to feed satellite end product factories at district levels and in rural areas (2) Model approach: 'Jumbo' plants and technical personnel; technology transfer; multiplier and demonstration effect (3) Process, equipment; bulk storage, materials handling, blending, bagging plant (4) Liquid fertilizers (5) Investment costs (6) Employment, management, training (7) Agriculture, multinational projects, economic implications. Reference: heavy industry.

ID/WG.282/26 — The Fertilizer Industry in India. Background Paper — E

Working Group No. 1 - Appropriate technology for heavy industries.
In co-operation with Fertilizer India Ltd.
Vienna, 1978. 64 p. Tables, Diagrams.

Covers (1) National economic implications of fertilizer; agriculture; food cereals; soils, crop yield; prices; distribution and marketing; sales outlets; organic fertilizer, farm waste utilization (composting); use of green manure as a source of nitrogen; agricultural development, expansion of use of production capacity; product mix; materials handling; packaging. Reference: urea, storage, warehouses, appropriate technology. Statistics.

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Language

ID/WG.282/65 — Thermophosphate Production in Mace Roasting Furnace (In 'Technologies from Developing Countries', Vol. II, page 1) — E
Vienna, 1978

Publication on thermophosphate fertilizer production for perennial plantation. - (1) Describes a low costs process based on apatite concentrate submitted to heat treatment (2) Covers (A) technical aspects and economic aspects (B) status of commercialization, giving contact address for further information. Additional references: organic acid, slag, charcoal fuel, furnace, appropriate technology, patents, Brazil.

ID/WG.282/65 — Fertilizer From Waste Hair (In 'Technologies from Developing Countries', Vol. II, page 8) — E
Vienna, 1978

Publication on hair waste utilization for fertilizer production. - (1) Describes a simple process for making an indigenous fertilizer from waste tannery and human hair rich in nitrogen (2) Covers (A) technical aspects and economic aspects (B) status of commercialization, giving contact address for further information. Additional references: leather industry, appropriate technology, pilot plant, India.

ID/WG.282/65 — Gobar Gas Plant (In 'Technologies from Developing Countries', Vol. II, page 175) — E
Vienna, 1978

Publication on a biogas plant providing gas and fertilizer slurry. - (1) Describes a plant which is easily constructed and uses the dung of five head of cattle as raw material for daily gas production sufficient for one family (2) Covers equipment costs and running expenses, medium lifespan (30 years), commercialization. Contact address is given. Additional references: energy, fuel, methane, rural area, appropriate technology, Pakistan. Diagram.

Meeting of Experts on the Insurance of Consequential Losses Incurred by Fertilizer Plants
Vienna, Austria, 18 - 20 September 1978

ID/WG.284/1 + Summary — Draft Report — E
Vienna, 1978. 53 p. Tables. — F S

Covers (1) Awareness in developing countries of the availability of relevant insurance cover (2) Existing insurance covering; areas of possible extension; costs estimates (3) Major gaps between present cover and buyers' requirements (4) Performance bonds. Further reference: contract, financial loss, machinery, factory. Annexes answers to UNIDO questionnaire, insurance samples, list of documents, list of participants. Recommendations.

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Expert Group Meeting on Industrial Financing
Vienna, Austria, 6 - 8 December 1978

		Language
ID/WG.287/3	Problems of Financing of Industrial Infrastructure (with Special Reference to the Fertilizer Industry) Vienna, 1978. 9 p. Covers (1) Infrastructure for a fertilizer factory and for effective distribution (2) Financing aspects (3) Terms and conditions of external sources of financing. Additional references: cost of capital, public financing, capital costs, production costs. Annexes a checklist for infrastructure requirements.	E F S

Technical Consultation on Corrosion in Fertilizer Plants
Sandviken, Sweden, 27 - 31 August 1979

ID/WG.303/1	Country Paper by Mauritius. Corrosion Problems Encountered at the Mauritius Chemical and Fertilizer Industry By G. Comarmond Vienna, 1979. 11 p. Graphs, Diagrams, Illustrations. Covers problems encountered (1) At a nitric acid plant (ammonia oxidation process) (2) In the liquid ammonia storage area. Additional references; tail gas, heating, cooling, technical aspects. Flow Chart.	E
ID/WG.303/2	The Corrosion of CO2 Stripper Gas Reboiler in P.T. Pupuk Sriwidjaja, Indonesia By U. Sumitro Vienna, 1979. 12 p. Diagrams. Publication on corrosion in fertilizer industry (urea plant) in Indonesia. - Covers: the plant; problems in the stripper gas reboilers; technical aspects; the failure and result of observations; discussion and corrective measures. Additional references: maintenance and repair, pipes, equipment.	E
ID/WG.303/3	Country Paper from India. Stress Corrosion Failures in Reformer Furnace Components By C.V. Srinivasan Vienna, 1979. 12 p. Graphs, Diagrams, Illustrations. Publication on corrosion problems in fertilizer industry (ammonia plant) in India. (1) Describes repeated and unusual occurrences of stress corrosion failures at the top inlet material components of the primary reformer furnace in an ammonia plant (2) Discusses experience in maintenance and repair and remedial actions to reduce incidence of failure. Additional references: metallurgy, welding, heat treatment.	E

Language

ID/WG.303/4 — A Presentation of Typical Equipment Corrosion Phenomenon in Large-Scale Ammonia Plants — E

(Country Paper from the People's Republic of China)
By Y. Zhong, W. Sun
Vienna, 1980. 8 p. Tables.

Covers (1) Typical case study of (A) primary reforming furnace tube failure (B) gas removal reboilers corrosion (C) corrosion in water cooling equipment (2) Analysis of causes; conclusions. Additional references; maintenance and repair, pipe.

ID/WG.303/5 — Urea Fertilizer Factory, Ghorasal, Dacca, Bangladesh. 660 MT/D Natural Gas Based Ammonia Plant — E

(Country Paper from Bangladesh)
By M.D. Sayeed
Vienna, 1980. 8 p. Tables.

Covers (1) Background and performance of factory based on natural gas, operating since 1970 (2) Technical aspects of process; catalyst being used (3) Failures in equipment; bottlenecks for capacity use (4) Problems encountered and preventive measures against corrosion. Additional references: steam, boilers, chemical reactors, maintenance and repair.

ID/WG.303/6 — Country Paper from Saudi Arabia. Special Corrosion Problem and the Repair at Safco — E

By I. Al-Makanzi
Vienna, 1980. 7 p. Diagrams.

Covers (1) Operating history and failure of an urea autoclave vessel after development of corrosion leak through bottom forging (2) Repair procedure (3) Causes of failure; conclusions (4) Stress-relieving of urea chemical reactors. Additional references: ammonia, maintenance and repair.

ID/WG.303/7 — Country Paper from Kuwait. Corrosion Problems Experienced in Ammonia and Urea Plants — E

By H. Abdel Nabi Bahaa
Vienna, 1980. 45 p. Tables, Diagrams, Illustrations.

Covers (1) Ammonia plants; case of (A) surface condensers of the ammonia compressors (B) overhead condenser (2) Corrosion in urea plant, occurring mainly in the chemical reactors and let-down valve, the high-pressure decomposer and the carbonate pumps (3) Causes of failure; visual inspection, macroscopic and microscopic examination, chemical analysis. Additional references: cooling, sea water, natural gas, maintenance and repair, galvanic corrosion, pipe.

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Language

ID/WG.303/8 + Add. 1 — Report (Consultation on Corrosion in Fertilizer Plants) — E
Vienna, 1979. 26 p.

Covers (1) Organization of the meeting (2) Summarizes papers and discussions on experience of Bangladesh, China, India, Indonesia, Saudi Arabia, Kuwait, Tunisia and Sweden, with reference to plants producing ammonia, urea, sulphuric acid, phosphoric acid, nitrogen, nitric acid, etc. Additional references: steel, alloys, welding, sea water cooling, coatings. List of Participants, List of Documents, Meeting Evaluation.

Seminar - Workshop on the Exchange of Experiences and Technology Transfer on Mini Hydro Electric Generation Units
Kathmandu, Nepal, 10 - 14 September 1979

ID/WG.305/27 — Seminar Report on Development of Small-Scale Hydro-electric Power and Fertilizer Production in Nepal — E
In co-operation with Asia Society (SEADAG), New York
Vienna, 1980. 19 p.

Covers (1) Current energy situation, forestry, problems of deforestation; relevant studies (2) Hydrological data for small rivers; small hydro-projects; social and economic aspects; rural development (3) International experience in this field; appropriate technology for turbines, generators, etc. costs (4) Mineral resources; nitrogen fertilizer production (using electrolysis); electric ARC process; choice of technology (5) Rural area energy balance; village electrification. List of Participants.

Fifth Meeting of the Working Group on Model Contracts for Fertilizer Plants
Vienna, Austria, 26 - 30 March 1979

EX. 81 — Report of the Meeting — E
Vienna, 1979. 6 p.

Covers the preliminary draft of the UNIDO models form of a costs reimbursable contract, indicating required changes.

Expert Group Meeting on UNIDO Model Forms of Contract for Fertilizer Plants
Vienna, Austria, 26 - 30 November 1979

ID/WG.306/1 — Second Draft of the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant — E F S
Vienna, 1979. 126 p.

Covers 46 contract articles and (in a separate addendum) technical aspects and specifications for an ammonia-urea complex based on natural gas. Background references: establishment of new industry, technology transfer.

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Language

ID/WG.306/2 + Add. 1 — First Draft of the UNIDO Model form of Turn-Key Lump-Sum Contract for the Construction of a Fertilizer Plant — E F S
Vienna, 1979. 171 p.

(1) Covers 47 contract articles (2) Appends technical material prepared for an ammonia-urea complex based on natural gas. Background references: establishment of new industry, technology transfer.

ID/WG.306/3 — Type of Performance Bond That Might be Included in the UNIDO Model Forms of Contract — E
Vienna, 1979. 12 p.

Publication on alternative types of performance bond for possible inclusion in the UNIDO model forms of contract for fertilizer industry. - Covers (1) Performance bond payable (A) on demand to the purchaser (B) after default by the contractor has been proved to the surety and after the surety has taken all steps to fulfill specific performance of the contract (2) Coverage and estimated costs of the performance bond (3) IBRD practice on performance bonds. Additional references: factory, technology transfer, purchasing, insurance, dispute settlement.

ID/WG.306/4 — Draft Report (Meeting on UNIDO Model Forms of Contract for Fertilizer Plants) — E F S
Vienna, 1980. 28 p.

Covers (1) Organization of the meeting (2) Second draft of the UNIDO Model Form of Costs Reimbursable Contract for the Construction of a Fertilizer Factory (3) First Draft of the UNIDO Model Form of Turn-Key Lump-Sum Contract for Plant Construction (4) General comments. Background reference; technology transfer. Recommendations, List of Documents, List of Participants.

Third Consultation on the Fertilizer Industry
Sao Paulo, Brazil, 29 September - 4 October 1980

ID/WG.318/1 + Add. 1 — Second Draft of the UNIDO Model Form of Turn-Key Lump-Sum Contract for the Construction of a Fertilizer Plant — E F S C
Vienna, 1980. 2 Vol. (Various pagings).

Covers (1) A contract specific to an ammonia-urea complex containing 40 articles (2) Technical aspects (see Addendum). Additional references: technology transfer, establishment of new industry.

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		Language
ID/WG.318/2 + Add. 1 + Corr. 1	First Draft of the UNIDO Model Form of the Semi-Turn-Key Contract for the Construction of a Fertilizer Plant. Vienna, 1980. 2 vol. (various pagings). Covers (1) A contract specific to an ammonia-urea complex containing 40 articles (2) Technical aspects and specifications (see Addendum). Additional references: technology transfer, establishment of new industry.	E F S C E
ID/WG.318/3 + Add. 1	Third Draft of the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant Vienna, 1980. 2 vol. (various pagings). Covers (1) A contract specific to an ammonia-urea complex containing 40 articles (2) Technical aspects and specifications (see Addendum). Additional references: technology transfer, establishment of new industry.	E F S C
ID/WG.318/4	Second Draft of the UNIDO Model Form of Turn-Key Contract for the Construction of a Fertilizer Plant. Comments Prepared by an International Group of Contractors Vienna, 1980. 49 p. Contains itemized consolidated comments from process plant contractors in France, Japan, UK, USA and Germany FR for submission to the Third Consultation Meeting on the Fertilizer Industry. Additional references: technology transfer, establishment of new industry, UNIDO.	E C
ID/WG.318/5	Third Draft of the UNIDO Model Form of Cost Reimbursable Contract for the Construction of a Fertilizer Plant. Alternative Draft (Counter-Proposal) Prepared by an International Group of Contractors Vienna, 1980. 110 p. Contains alternative contract specific to an ammonia-urea complex as put forward by contractors from Germany FR, France, Japan, UK and USA. Additional references: technology transfer, establishment of new industry.	E C
ID/WG.318/6	Establishing a Multilateral Insurance Scheme Providing Adequate Coverage for Consequential Losses Incurred by Fertilizer and Other Industrial Plants Vienna, 1980. 24 p. Tables. (1) Reviews history of proposal (2) Covers (A) amount and causes of consequential losses in fertilizer factories (B) results of UNIDO discussions with governments, contractors and insurers (C) approach, concept, principles and advantages of the suggested insurance policy. Additional references: technology transfer, contract, establishment of new industry.	E F S R C

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		Language
ID/WG.318/7	Progress Report on Actions Recommended by the Second Consultation Vienna, 1980. 20 p. Tables. Covers action related to (1) UNIDO Model Forms of Contract for Factory Construction (2) A Multilateral Insurance Scheme Against Consequential Financial Losses (3) Costs of new projects (4) Monitoring global level fertilizer supply and demand (5) Role of developing countries in co-operation (6) Updating UNIDO studies (7) Development in least developed countries. Forecasts, Statistics.	E F S R C
ID/WG.318/11	FAO Activities in Promoting and Overcoming Constraints to the Efficient and Complementary Use of Mineral Fertilizers, Organic Materials and Biological Nitrogen Fixation by Small-Scale Farmers in Developing Countries In co-operation with FAO. Vienna, 1980. 14 p. Tables. Covers (1) Agricultural consumption and food production in developing countries (2) Use and effects of mineral fertilizers, considering value cost ratio in crop yield (3) Use of organic materials (manure, compost, biomass, etc.); organic recycling (4) Biological nitrogen fixation (using leguminous crops providing nitrogen to the soil); microbiology aspects, the symbiotic bacteria rhizobia; the fern azolla; research (5) Constraints to fertilizer use; FAO activities; the 'International Fertilizer Supply Scheme' (IFS). Additional references: rice, maize, agricultural wastes, U.EP, biogas, composting. Statistics.	E
ID/WG.318/12	Issues Affecting Development of the Fertilizer Industry in the 1980's Vienna, 1980. 16 p. Tables. Covers (1) Progress made by developing countries towards self-sufficiency in fertilizer production; prospects to 1990 (2) Supplies of ammonia, phosphate, sulphur and potash (3) Fertilizer prices and import costs (4) The high cost of factories (5) Mini-plants (6) Assistance from governments of developed countries (7) Optimum level of fertilizer consumption in DC's in 1990 and 2000. Additional references: nitrogen, phosphoric acid, financing, role of UNIDO. Statistics.	E F S R C
ID/WG.318/14/ Rev. 1 (ID/260)	Report (Third Consultation on the Fertilizer Industry) Vienna, 1980. 38 p. Covers (1) Progress on actions recommended by the 2nd and new issues proposed for consideration by the 4th Consultation (2) UNIDO Model Forms of Contracts (Costs Reimbursable and Turnkey) for Construction of a Fertilizer Factory (3) Multilateral insurance schemes to cover consequential financial losses (4) Co-operation among the developing countries (5) Capital costs for fertilizer plants; mini-plants. Recommendations, List of Participants, List of Documents.	E F S R C

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Technical Consultations Among Developing Countries in Large-Scale Biogas Technology in China
Beijing, China, 4 - 19 July 1980

Language

ID/WG.321/10 The Utilization of Biogas Fermentation Residue-Sludge and Effluent — E
In co-operation with Institute of Soil and Fertilizer, Sichuan, China
Vienna, 1980. 16 p. Tables.

Publication on biogas production with fermentation waste utilization for organic fertilizer. - Covers (1)Biogas popularization and development of agriculture production (2) Manure efficiency and increased crop yields using biogas fermented residues; technical aspects of the process; advantages over traditional composting methods; results of experimentation; nutrient content, nitrogen; phosphorus-humate application to various crops (3) Using digester sludge for soil improvement (4) Breeding fish with digester residue. Statistics.

First Meeting of the Ad Hoc Committee on Co-operation Among Developing Countries in the Fertilizer Industry
Nairobi, Kenya, 11 - 13 March 1980

ID/WG.322/1 Co-operation Among Developing Countries in the Fertilizer Industry — E C
Vienna, 1980. 53 p.

Presents suggestions (1) From Brazil, China, India, Indonesia, Mexico and Senegal (2) From regional and interregional manufacturers associations, namely ADIFAL, IFDC, ISMA and the Arab Federation of Chemical Fertilizer Producers. Additional references: technology transfer, appropriate technology, joint venture, training programmes, raw materials, role of UNIDO. Latin America, Arab Countries.

ID/WG.322/2 Report (Meeting on Co-operation in the Fertilizer Industry) — E F S
Vienna, 1980. 18 p.

Covers (1) Implementation of action programme recommended by UNIDO's Second Consultation (2) Additional areas of co-operation (3) Mechanisms for implementing co-operation. Additional references: training assistance, advanced technology, financing, establishment of new industry, information service, role of UNIDO, technical assistance. Annexes outline of steps required for setting up viable fertilizer industry. Recommendations, List of Participants, List of Documents.

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Round-Table Ministerial Meeting on Agro-Industry Development
Baghdad, Iraq, 19 - 24 January 1980

		Language
ID/WG.328/14	The Development of Chemical Fertilizers Production in Iraq By M. Al-Shukkry, N. Dabdal Vienna, 1980. 40 p. Tables. Covers (1) World population growth and problems of food production (2) Chemical fertilizer use in Iraq; agriculture, cultivated and fertilized land; crops (3) Planning; fertilizer consumption in Iraq and other countries; prospects to 1986; development potential. Statistics. Additional references: government policy, imports.	E F S

Interregional Meeting on Safety in Production, Transportation and Storage of Fertilizers
New Delhi, India, 8 - 10 December 1980

ID/WG.333/1	Explosion Hazards in Urea Plants and its Prevention By E. Dooyeweerd Vienna, 1980. Graph, Diagram. Covers (1) Process of urea synthesis; need for highly corrosion-resistant equipment in plants (2) Explosion dangers from hydrogen-nitrogen-oxygen mixtures (3) Examples of some purified non-condensable gas mixtures (4) An approach to solving the problem of explosion hazards; experience in Switzerland. Additional references; carbon dioxide, ammonia, chemical reactors, fertilizer industry.	E
ID/WG.333/2	Factors Governing Corrosion During the Safe Production of Sulphuric Acid and Phosphoric Acid By P. Becker Vienna, 1980. 30 p. Tables, Graphs, Diagrams. Covers (1) Major improvement in corrosion prevention in sulphuric acid equipment (tube and shell acid coolers with anodic protection) (2) Corrosion problems in phosphoric acid production: physical factors and temperature; chemical factors (sulphuric acid, fluorine, chlorine) (3) Corrosion in fertilizer industry, methods of investigation. Additional references: maintenance and repair, alloys, cooling, intermediates. Statistics, Flow Charts, Bibliography.	E

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Language

ID/WG.333/3 — Safety Aspects of Production, Storage and Transport of Fertilizers Containing Ammonium Nitrate — E

By G. Perbal
Vienna, 1980. 17 p. Tables, Graphs, Diagrams.

Covers (1) Hazardous properties of such fertilizers: detonation, self-sustaining decomposition, self-heating, fume-off, oxidizing capacity (2) Transport and safety regulations (3) Rules to be observed by manufacturers (4) Control testing methods applied by authorities (5) Self heating of complex fertilizer (6) Safety in rotary drying operation. Bibliography, Chemical analysis table.

ID/WG.333/4 — Ammonia Plant Safety. A Review of the Silver Anniversary Symposium on Safety in Ammonia Plants and Related Facilities — E

By T.A. Sandow
Vienna, 1980. 11 p.

Covers (1) Papers presented at a meeting of the ' American Institute of Chemical Engineers' pointing out the importance of (A) teamwork between designer and factory operator (B) operator training and review programmes (C) well-planned maintenance and repair programmes, with special attention to preventive maintenance (2) Relates experience of incidents, catastrophes and of preventive measures at various plants. Additional references: fertilizer industry, temperature, catalyst, equipment. Bibliography.

ID/WG. 333/5 — Safety Systems Involved in Handling, Storage and Transportation of Liquid Ammonia Including Ammoniacal Solutions — E

By W. Rall
Vienna, 1980. 15 p. Diagram.

Covers (1) Methods of storage of liquid ammonia; full and semi-refrigeration; pressure storage at ambient temperature; storage location and equipment (2) Transport of liquid ammonia by pipelines, sea transport, rolling stock, road transport (3) Safety in materials handling; maintenance and repair aspects, emergency procedures (4) Storage and transport of water-ammonia solutions. Bibliography. Flow Chart.

ID/WG.333/6 — In-House Team Improves Safety, Production and Profitability — E

By S.I. Quraidis
Vienna, 1980. 13 p. Tables, Diagram.

Covers (1) Experience of an urea factory in Saudi Arabia; problems; major technical modifications carried out to secure plant and personnel safety (2) Engineering modification: primary reformer furnace; urea plant revamp; ammonia storage tank (3) Improved operational maintenance and repair and safety-oriented procedure. Additional references: catalyst tubes, equipment replacement.

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Language

ID/WG.333/7 — Environment and Plant Prot[illegible]on in the Operation of Centrifugal Compressors of [illegible]Large Ammonia Plant — E
By T. Berriola, G. Gramatica, L. Mariani
Vienna, 1980. 18 p. Diagrams.

Covers (1) Importance of proper engineering design and process control for avoiding catastrophic failures (2) Emergency analysis; identification, classification and resolution; safety audit (3) Operation of centrifugal compressors; syngas, natural gas, process air, refrigeration (4) Emergencies arising from loss of utilities. Additional references: fertilizer industry, pollution control, power supply.

ID/WG.333/8 (ID/264) — Safety in the Production, Transportation and Storage of Fertilizers. Report of an Interregional Meeting — E
Vienna, 1980. 28 p.

(1) Covers meeting background (2) Summarizes (a) papers and discussions concerning: engineering design; operational considerations, maintenance and repair safety in ammonia plants and related facilities; materials handling and storage (b) case studies and country reports. List of documents.

First Meeting of the Expert Group to Exchange Experiences in the Construction and Operation of Fertilizer Plants in the Developing Countries
Vienna, Austria, 7 - 11 December 1981

PC. 30 — Report of the Meeting — E F
Vienna, 1981. 28 p.

Report of a meeting on factory establishment and operation in the field of fertilizer industry in developing countries. - Identifies and comments on problems encountered in project implementation and plant operation. Recommendations, Agenda, List of Participants.

Technical Conference on Ammonia Fertilizer Technology for Promotion of Economic Co-operation among Developing Countries
Beijing, People's Republic of China, 13 - 28 March 1982

ID/WG.364/1 — Reactor Designs and Catalysts from Ammonia Synthesis — E
By U. Zardi
Vienna, 1982. 27 p. Tables, Diagrams.

Covers (1) Evolution of synthesis technology to meet new requirements for large production capacity plus energy saving (2) State of the art; advanced technology; possible future developments. Statistics, Bibliography.

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Language

ID/WG.364/2 Hydrogen Recovery from Ammonia Purge Gas. The Petrocarbon Experience — E

By W.H. Isalski
Vienna, 1982. 17 p. Tables, Diagram.

(1) Outlines a technology for such hydrogen recovery (2) Describes the process aspects and considers the economic aspects of installing and operating a typical unit (3) Considers the effect on the ammonia plant and uses operating experience to discuss plant flexibility. Process statistics, flow chart. Additional reference: fertilizer industry.

ID/WG.364/3 Criteria for Selecting CO2 Removal Processes — E

By F.C. Brown
Vienna, 1982. 13 p. Diagrams.

Publication on ammonia fertilizer technology, with special reference to major processes available for the removal of carbon dioxide from synthesis gas streams produced by the catalytic steam reforming of natural gas. - Covers (1) Historical development (2) Use of ethanolamines (3) Hot carbonate processes (4) Physical solvents (5) Improved chemical absorbent processes (6) Performance data (7) Factors in choice of technology. Technical flow charts. Additional references: chemical reactors, recovery.

ID/WG.364/4 Hydrogen Recovery from Ammonia Plant Purge Gas via Prism Separators — E

By J.M. Van Gelder
Vienna, 1982. 13 p. Tables, Diagrams.

Describes the operating performance of a PRISM separator system for recovery of hydrogen from a natural gas fed nominal 1000 MTPD ammonia plant, the concept applying equally to all sizes of ammonia plant purge streams. Process Statistics, Flow Chart.

ID/WG.364/5 Corrosion Problems in an Ammonia Plant. Case Histories — E

By V.R.R. Gupta, T.R. Sabapathy, C.V. Srinivasan
Vienna, 1982. 15 p.

Presents some case studies on the various types of corrosion-caused failures of equipment experienced in a fertilizer industry in India and on corrosion prevention measures adopted. Additional references: reformer, condenser tubes, heat exchanger, compressors, carbon dioxide, boilers, maintenance and repair.

ID/WG.364/6 Energy Conservation in Ammonia Plants — E

By G.D. Honti
Vienna, 1982. 27 p. Graphs, Diagrams.

Covers: energetic aspects in a modern plant; energy recovery; energy balance and opportunities for conservation; steps to improving thermodynamic efficiency; steam reforming furnaces; carbon dioxide removal; compressors and drives; finding more efficient steam reforming flowsheets; purge gas recovery; high purification of synthesis gas; possibilities for developing countries. Process flow charts, Statistics, Bibliography.

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Language

ID/WG.364/7 — Future Trends in Ammonia Technology — E

By A.S. Nawaz
Vienna, 1982. 12 p. Table.

Covers (1) Historical aspects and current status (dealing only with steam reforming processes) (2) Improvements (a) in classical ammonia technology for the near and more distant future (b) in non-classical technology (3) Advanced technology, innovations: nitrogen fixing crops; ammonia from enzymes; new chemical approaches; the ultimate biochemistry process. Bibliography.

ID/WG.364/8 — Jordan Phosphate Mines Company — E

By Y.A. Abu-Rish
Vienna, 1982. 10 p. Diagrams.

Describes (1) Operations of the Jordan Fertilizer Industry at Aqaba, producing sulphuric acid, phosphoric acid and aluminium fluoride, and having a granulation plant (2) An oil shales project at El-Lajjun. Flow charts. Additional reference: ammonia.

ID/WG.364/9 — Ammonia Industry in India — E

By K.S. Sarma
Vienna, 1982. 16 p.

Covers (1) Development of the industry since the 1940s and action taken to achieve self-sufficiency in engineering design, construction and operation of fertilizer industry (2) Feedstock (3) Manpower development (4) Research and development (5) Design and engineering (6) Equipment manufacture (7) Problems (8) Training programmes. Annexes list of ammonia plants with details of operations.

ID/WG.364/10 — Fertilizer Production in Zambia. Facilities and Problems — E

By I.M. Liayo
Vienna, 1982. 6 p. Tables.

Covers (1) Process used at factory in Kafue; production of ammonium nitrate, ammonia, nitric acid and nitrogen fertilizer; production capacities (2) Raw materials, transport, choice of technology; technical personnel; financial aspects, foreign exchange; problems of equipment supply; co-operation.

ID/WG.364/11 — 200 MT/D Ammonia Plant with Heavy Oil as Feedstock — E

By Li Shaoquing, Zhang Jinzhong
Vienna, 1982. 20 p. Tables, Diagrams, Illustrations

Publication on ammonia production in China using heavy oil as feedstock. - Covers (1) Features of the process; gasification; purification of the crude gas; synthesis of ammonia; the steam system (2) Process description: composition and physical properties of the feedstock (3) Discussion of major technical questions; operating experiences. Statistics, Bibliography, Flow Chart. Additional references: energy saving, heat recovery, petroleum, carbon black, oxygen.

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Language

ID/WG.364/12 — Periodical Inspection and Treatment of Defects on Ammonia Converters — E

By Yao Zu Yun
Vienna, 1982. 16 p. Table.

Publication on preventive maintenance and repair on ammonia converters. - (1) Analyses causes and treatment of frequently found defects and illustrates merits of regular periodical inspection (2) Covers inspection procedures and specifies corrective action. Additional references: equipment, nitrogen, fertilizer industry.

ID/WG.364/13 — Developments in Catalysts for Water-Gas Shift, Methanation and Ammonia Synthesis in China — E

By Chen Wuzheng
Vienna, 1982. 15 p. Tables, Graphs.

Covers (1) Major developments in catalysts for water-gas shift, methanation and ammonia synthesis since the 1950s (2) Research results and characteristics; experience in performance under operational conditions. Process statistics. Additional references: sulphur, thermostability.

ID/WG.364/14 — How China has Developed its Ability of Building Nitrogenous Fertilizer Plants — E

By Han Xue-Tong
Vienna, 1982. 12 p. Illustrations.

Outlines development of construction with attention to methods and special reference to (1) Operational research and project evaluation techniques (PERT) (2) Use of domestic transport and hoisting machinery (3) Prefabricated building and pre-assembly (4) Strict management regulation and quality control.

ID/WG.364/15 — The Manufacture of High Pressure Vessels for Nitrogenous Fertilizer Plants — E

By Shi Huimin
Vienna, 1982. 22 p. Tables, Diagrams.

Publication on manufacture of equipment for synthetic ammonia plants (fertilizer industry) in China. - Covers (1) Present fabrication status of four types of structure of high pressure vessels and linings (2) Relevant technology, welding aspects, testing (3) Vessels for urea plants (4) Use of stainless steel lining; explosion linings (5) Quality control. Specifications. Additional references: industrial safety, chemical reactors, nitrogen.

ID/WG.364/16 — The Preparation and Gasification of Carbonated Lime Coal Briquettes — E

By Yang Yun Zao
Vienna, 1982. 24 p. Tables, Graphs.

Publication on preparation and gasification of carbonated lime coal briquettes used for making syngas in ammonia plants in China. - Covers: process for obtaining high

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Language

quality briquettes; their mechanical strength, thermal stability and rather high chemical reactivity; production of briquettes with enchanced ash fusion point; gasification technology; slag removal; characteristics of semi-water gas produced by the process. Specifications, process statistics, gasifier control data. Additional reference: carbon.

ID/WG.364/17 Study on the Structure of the Ammonia Converter Cartridge E

By Huang Wenyiong
Vienna, 1982. 22 p. Tables, Diagrams.

Publication on structure of ammonia converter cartridges used in China (reference: catalysts). - Gives summary and analysis of experimental data collected from experience in structural design and production of medium and small-sized converter cartridges since the 1960s, recommending use of (a) co-current two-bed converter cartridges with inner cooling tubes for medium-sized converters and (b) co-current single tubular exchanger with spiral plates for small-sized converters. Additional references: heat recovery, energy saving, steam.

ID/WG.364/18 The Chemical Fertilizer Industry in China E

By Liu Gang
Vienna, 1982. 14 p.

Covers (1) Background, number of plants; production capacity, self help (2) Practice stressed in efforts to speed development, with reference to: central and local level initiative; size of enterprise; domestically produced equipment and machinery; raw material and fuels; training (3) Special features; prospects. Additional references: phosphate, ammonia, coal.

ID/WG.364/19 The Viability of 200-300 MT/D Natural Gas Based Ammonia Plant E

By Wu Hong-ye, Xue Tian-xiang
Vienna, 1982. 10 p. Tables, Diagrams.

Publication on viability of a natural gas based ammonia plant with a production capacity of 200-300 MT per day (based on experience in China). - Covers: technical aspects; typical features; engineering design, centrifugal compressors, synthesis pressure, by-product steam, heat recovery and utilization; power consumption, energy saving. Bibliography, flow charts, process statistics.

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ID/WG.364/20 — Treatment of Recirculation of Cooling Water in a Nitrogenous Fertilizer Plant — E

By Feng Hua-you
Vienna, 1982. 21 p. Tables, Illustrations.

Publication on recirculation cooling water treatment in a nitrogenous fertilizer industry in China. - Covers (1) Selection of chemical treatment formulation appropriate to water quality; chemical analysis; test data of corrosion specimens (2) Strict monitoring and control of microorganisms to prevent contamination (3) Corrosion-resistant coatings (4) Field operation management. Additional reference: ammonia.

ID/WG.364/21 — Synthetic Ammonia Plant of 200 MT/D with Anthracite as Raw Material — E

By Yu Qingzu
Vienna, 1982. 12 p. Diagrams.

Publication on use of anthracite coal as a raw material in synthetic ammonia production in China. - Covers (1) Availability and quality of anthracite; its suitability for producing feed gas for synthetic ammonia with fixed bed gasification; economic aspects; chemical coke as raw material (2) Technological processes: methanation process, new copper liquor absorption process; catalysts (3) Planned improvements. Tables, flow charts.

ID/WG.364/22 — Combined Production of Ammonia and Urea - A Study on Integrated Urea Process with Shift Gas Stripping — E

By Yu Bing Liang
Vienna, 1982. 23 p. Tables, Diagrams, Graphs.

Publication on combined production of ammonia and urea in China, with special reference to the integrated urea process with shift gas stripping. - Covers (1) Background; principle of stripping with shift gas; laboratory experiments; brief description of the process (2) Selection of operating variables and discussion: urea chemical reactors, stripper, carbon dioxide absorber; condensation and recovery of ammonia from the nitrogen and hydrogen mixture; thermal balance; minimizing the steam consumption, commercialization and techno-economic evaluation. Statistics, flow chart.

ID/WG.364/23 — Application of Steam Gaseous Hydrocarbons Reforming Catalyst — E

By Feng Xiaoting
Vienna, 1982. 23 p. Tables.

Publication on ammonia production, with special reference to reforming catalysts (based on experience in China). - Covers (1) Primary reforming catalyst: principle properties; performance comparison; strength of Type Z-107 catalyst after the industrial operation; impurities; changes of physical-chemical parameters (2) Secondary reforming catalyst: activity at high temperature; heat resistivity. Additional references: fertilizer industry, nickel.

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HEAT DIAGNOSES
MADE ON TUNNEL KILNS AND ON BELT DRIER

Basic Information*

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Co-operation in the Field of Ceramics, Building Materials
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ABSTRACT

The publication deals with the diagnostic measurements of heat consuming units in the ceramic industry from the point of view of their operation, adjustment and energy conservation.

Two examples of diagnosis accomplished by means of a diagnostic mobile unit are presented - one diagnosis of a tunnel kiln for firing wall tiles, the other of a belt drier for washed kaolin. Technical parameters of the equipment are briefly described in both cases including the objectives of measurements. Diagnostic methods used and apparatuses applied during the measurements, testing results and their evaluation are presented. Recommendations on technical and operational measures to be taken to improve the conditions of material thermal treatment and to achieve energy conservation are worked out on the basis of the testing results. They form an inseparable part of each technical report on diagnostic measurements. Expected contributions which would be acquired by the realization of the recommendations are mentioned, too.

Table of Contents

Page

ABSTRACT 2

INTRODUCTION 4

I. TUNNEL KILN FOR FIRING WALL TILES 6

1. Technical Parameters
2. Objective of Measurement
3. Diagnostic Method and Applied Apparatuses
4. Testing Results
5. Evaluation of Testing Results
6. Recommendations

Tables 1 - 5

II. BELT DRIER FOR WASHED KAOLIN 22

1. Technical Parameters
2. Objective of Measurement
3. Diagnostic Method and Applied Apparatuses
4. Testing Results
5. Evaluation of Testing Results
6. Recommendations and Expected Contributions

Tables 6 - 8

III. FINAL NOTE 35

IV. REFERENCES 36

ANNEX

Figures 1 - 8

... ----- ...

INTRODUCTION

To meet the requirements of the developing countries for information on practical performance of diagnostic measurements, the UNIDO-Czechoslovakia Joint Programme in Pilsen elaborated this publication giving an example of two diagnoses. A lot of equipments in ceramic plants in the developing and least developed countries operate under conditions which are quite different from the optimal ones and consequently, the reject occurrence is high, quality of products is low and also energy conservation is too high.

Diagnostic measurements give a detailed information about the operation of the respective equipment measured and thus provide the system of energy management with the data necessary for decision making with regard to the modernization of the equipment. On the basis of the data obtained, a study is worked out. Within this study, conclusions and recommendations are presented to assist the producer in operational adjustment, production intensification, quality improvement, reduction of reject occurrence and in energy conservation measures.

The activities performed during the measurements comprise three fundamental stages:

- statement of the thermal unit operation conditions, performance of objective tests and functional measurements
- evaluation of the tests and measurements
- working out proposals on technical, energetical, operational and organizational measures or recommendations on a complete reconstruction

There are two basic types of diagnostic measurements focused either on the technological process optimization or on energy conservation.

Nevertheless, the complex measurements, e.g. combination of technological and energetical types, are most advisable for the purpose of energy management. The complex measurements provide the team of experts with complete information about the unit. Thus they can prepare an objective and complex statement for the user of the heat consuming unit, draft all suitable and recommendable adjustments and necessary changes which are to be realized with a view to the perfect and efficient service of the unit.

The most important data, investigated during the diagnostic measurements, are as follows:

- course of thermal treatment
- temperature distribution in the inner space of the kiln (drier)
- relative humidity of the drying medium in the drier
- heat balance of the unit
- combustion gases analysis
- fuel consumption and heating value fluctuation

I. TUNNEL KILN FOR FIRING WALL TILES

1. Technical Parameters

	Project	Reality
Type:	semimuffled tunnel kiln	
In operation since:	1976	
Fired product:	biscuit wall tiles 150 x 150 mm	
Internal dimensions:	l x w x h : 120.80 x 1.16 x 1.30 m	
Firing temperature:	1060 ^{o}C	
Fuel:	town gas calorific value = 14455 kJm^{-3}	
Number of burners:	58 (29 on each side)	
Number of kiln cars in the kiln:	68	
Output (m^{2} per year):	1 870 000	1 618 000
Setting on one kiln car:	160 m^{2}	160 m^{2}
Firing cycle:	51 hours	59 hours
Reject:		7.1 %
Specific heat consumption:	3 720 kJkg^{-1}	4 465 kJkg^{-1} /+

/+ Average value during one month preceding the measurements

The diagnostic measurement was accomplished in 1982.As far as that time, the kiln had worked without interruption and the reject occurrence decreased from the initial value of about 10% down to 7.1% at the time of measurements. During the measurements, the kiln operated under stabile conditions, e.g. uniform kiln car advance and no interruption in its operation.

2. Objective of Measurement

The producer operates two other kilns of a similar type for bisque firing of wall tiles with a considerably lower reject (3.8 and 4.1%). Also specific consumption of the kiln is almost 20% higher than the projected one while the firing cycle is longer and output lower than the projected parameters. To improve this situation, the producer ordered diagnostic measurements of the kiln with the following requirements:

- improvement of firing conditions to reduce the reject occurrence
- reduction of specific consumption
- increased output

3. Diagnostic Method and Applied Apparatuses

To fulfil the target of measurements, the following data were determined:

- firing curve and temperature distribution in the cross-section of the kiln
- combustion gases analyses
- pressure curve
- fuel consumption
- fuel quality (composition and calorific value)
- heat balance of the kiln

To investigate the firing conditions, a measuring kiln car wa used equipped with four jacketted thermocouples Ni - NiCr (see Figure 1). The positions of measuring points were chosen with regard to the symetrical reject occurrence on the left and right sides of the kiln and higher concentration of reject in the lower part of the setting. The thermocouples were put

through the drilled-out lining of the kiln car. They were connected with a recorder by a compensating lead wire which was strained through the inspection tunnel under the kiln (see Figure 2). The kiln atmosphere samples were taken through the sight holes of the kiln and analyzed by means of analysers - Infralyt (CO_2) and Permolyt (O_2) (see Figure 3).

The kiln atmosphere pressure was measured through the sight holes by a precise micromanometer with changeable response.

The town gas consumption was measured by an installed calibrated gas meter. The composition of gas and its average calorific value were determined in a laboratory. The gas quality fluctuation was checked by a Wobbe's number meter. The air and combustion gases flow velocity was measured either by anemometers (suckings of fans) or by a Pitot's tube and micromanometers (pipelines). The surface temperatures were measured by a digital contact thermometer with Ni - NiCr sensors. As for the heat balance, attention was paid to the heat losses which could be deprived of or, at least, reduced by a new adjustment of the kiln. Therefore, neither the thermal loss through the brickwork nor technological loss were determined.

4. Testing Results

Parameters of gas

Consumption of town gas in respective days of measurement and its average consumption presents Table 1. Average gas composition during the time of testing shows Table 2. The heating value fluctuation expressed by percentage of average Wobbe's number value is presented in Table 3.

Firing conditions

Firing curves measured in four measuring points in the kiln cross-section presents Figure 4. The pressure curve of the kiln atmosphere, CO_2 and O_2 concentration are shown in Table 4 and Figure 5. Table 5 presents the theoretical need of oxygen and amount of combustion products in dependence on the gas composition.

Theoretical need of oxygen for firing 1 m^3 of gas is 0.7660 m^3. This amount of oxygen in the air is accompanied by nitrogen:

$$0.7660 \times \frac{79}{21} = 2.8816 \ m^3$$

Theoretical need of firing air for firing 1 m^3 of gas:

$$V_{at} = 0.7660 + 2.8816 = 3.6476 \ m^3$$

Theoretical volume of dry combustion products formed by firing 1 m^3 of gas:

$$V_{dt} = 2.8816 + 0.0220 + 0.481 = 3.3846 \ m^3$$

Theoretical volume of wet combustion products:

$$V_{we} = 3.3846 + 0.9370 = 4.3216 \ m^3$$

Real volume of combustion products

It had to be determined indirect from the concentration of CO_2 in stack draught. This concentration fluctuated to a minimum extent during the time of measurement and the average value was 2.45%.

The real amount of dry combustion products can be determined from the CO_2 theoretical content devided by the real one:

$$V_{dr} = \frac{0.481}{2.45} \times 100 = 19.6326 \text{ m}^3 \text{ per } 1\text{m}^3 \text{ of gas}$$

The air excess coefficient for this amount of combustion products:

$$n = \frac{V_{dr} - (CO_2 + N_2 \text{ in combustion products})}{V_{at}} =$$

$$= \frac{19.6326 - 0.481 - 0.022}{3.6476} = 5.24$$

Heat balance

Heat input by fired gas:

$$\dot{Q}_g = \dot{V}_g \times H_g = \frac{580.2}{3600} \times 14184 = 2\ 286 \text{ kW}$$

$\dot{V}_g$ ..... gas consumption ($m^3\ s^{-1}$)

H_g ..... calorific value of the gas ($kJ\ m^{-3}$)

Heat loss by the air from the cooling zone

The warm air is piped from the cooling zone through the piping of circular cross-section with the diameter 1.0 m. The air flow velocity was calculated from dynamic pressure measured by Pitot's tube and precise manometer in two mutually perpendicular diameters. The average air flow velocity:

$v_a = 5.05 \text{ m s}^{-1}$

Static pressure of air: 22 Pa

Temperature: $t_{ac} = 138\ ^{o}C$

Specific mass: 0.795 kg m^{-3}

Quantity of air, draught from the cooling zone, recalculated for normal conditions:

$\dot{V}_{ac} = 2.63 \text{ m}^3 \text{ s}^{-1}$

Heat loss:

$\dot{Q}_{ac} = \dot{V}_{ac} \times C_{ac} \times (t_{ac} - 20) = 2.63 \times 1.306 \times 118 = 405.3 \text{ kW}$

C_{ac} - specific heat of air ($\text{kJ m}^{-3} \text{ K}^{-1}$)

t_{ac} - temperature of air (^{o}C)

Flue loss

The real amount of wet combustion products:

$V_{wr} = V_{dr} + V_{H_2O} = 19.6326 + 0.937 = 20.5696 \text{ m}^3$ per 1 m^3 gas

$\dot{V}_{wr} = V_{wr} \times$ gas cons. per second $= 3.315 \text{ m}^3 \text{ s}^{-1}$

temperature of comb. products: $t_{cp} = 226\ ^{o}C$

Flue loss: $\dot{Q}_f = \dot{V}_{wr} \times c_{cp} \times /t_{cp} - 20/ = 3.315 \times 1.313 \times 206 =$

$= 896.5 \text{ kW}$

c_{cp} - specific heat of comb. products ($\text{kJ m}^{-3} \text{ K}^{-1}$)

t_{cp} - temperature of comb. products (^{o}C)

Accumulated heat

The loss by heat accumulated in products and in kiln cars was calculated from average temperature, specific heat and material flow of respective material. The temperature was measured in the upper, central and lower parts of the setting on the surface as well as inside the setting. The temperature of kiln car lining and the temperature of iron boggie was measured in four different points. Three cars per day were measured this way. The average temperatures of individual materials were used for calculations.

Heat flow by the heat accumulated in setting:

$$\dot{Q}_{as} = \dot{m}_s \times c_s \times (t_s - 20) = 0.513 \times 0.791 \times 145.0 = 58.8 \text{ kW}$$

$\dot{m}_s$ ..... material flow of setting (kg s^{-1})

c_s ..... specific heat of setting (kJ kg^{-1} K^{-1})

t_s ..... average temperature of setting (^oC)

Heat flow by the heat accumulated in kiln car lining:

$$\dot{Q}_{al} = \dot{m}_l \times c_l \times (t_l - 20) = 0.375 \times 0.893 \times 116 = 38.8 \text{ kW}$$

$\dot{m}_l$ ..... material flow of kiln car lining (kg s^{-1})

c_l ..... specific heat of kiln car lining (kJ kg^{-1} K^{-1})

t_l ..... average temperature of kiln car lining (^oC)

Heat flow by the heat accumulated in kiln car iron boggie:

$$\dot{Q}_{ab} = \dot{m}_b \times c_b \times (t_b - 20) = 0.119 \times 0.476 \times 89 = 5.0 \text{ kW}$$

$\dot{m}_b$ ..... material flow of iron boggie (kg s^{-1})

c_b ..... specific heat of iron (kJ kg^{-1} K^{-1})

t_b ..... average temperature of iron boggie (^oC)

Total loss by accumulated heat:

$$\dot{Q}_{at} = \dot{Q}_{as} + \dot{Q}_{al} + \dot{Q}_{ab} = 58.8 + 38.8 + 5.0 = 102.6 \text{ kW}$$

Review of Heat Balance

	kW	%
Heat input	2 286	100
Loss by cooling air	405.3	17.72
Flue loss	896.5	39.20
Loss by accumulated heat	102.6	4.49
Other losses (technological, through brickwork, by leakage, to foundations, etc.)	881.6	38.59

Graphically is the heat balance expressed in Figure 6.

Specific consumption of the kiln:

Output	0.513	kg s^{-1}
Heat input	2 286	kW
Specific consumption of heat for firing 1 kg of products:	4 456	kJ kg^{-1}

5. Evaluation of Testing Results

Firing conditions

The temperature difference between the lower and upper part of the setting in the preheating zone is considerably high and goes above 150°C. Temperature equalization causes too high temperature gradient in the lower part of cross--section, interval of 500 - 750 °C where the fired material is sensitive to temperature changes due to α-β quartz transformation. This temperature rise causes a part of cracks in fired tiles. The firing curve in the upper part of the setting is favourable.

The temperature is very well equalized in the cross-section in the firing zone.

The course of cooling can be improved by a rapid temperature drop from the firing temperature to 700°C. The fired body shows high thermal shock resistance in this interval and the measure enables to slow down the temperature decline from 600 to 500°C. Cooling under 450°C should be rapid again to lower the outlet temperature and thus the loss by accumulated heat.

Pressure conditions

The underpressure at the beginning of the preheating zone amountsto - 20 Pa. Together with overpressure of 11 Pa at the end of the preheating zone, it causes a too rapid flow of combustion gases which does not enable the proper heat transfer between the combustion products and the heated material.

The kiln is equipped with a system of openings to the stack draught in the first eight sections. The openings are located in two levels, one of them being at the level of kiln car platforms, the other by 0.6 m higher. 25% of outlets are

opened in lower level, 50% of them in higher one.

The maximum overpressure of 11 Pa is rather high and sets in in a considerably long part of the kiln. It causes the penetration of the kiln atmosphere to the inspection tunnel and increases the loss by leakage.

Kiln atmosphere

The CO_2 and O_2 concentrations prove proper adjustment of burners in firing and preheating zones. The rapid decline of CO_2 concentration at the beginning of the kiln and low CO_2 concentration in stack draught show the infiltration of air into the kiln due to high underpressure in the preheating zone.

Gas quality and consumption

The differences of Wobbe's number did not exceed ± 3% of average value (see Table 3). Short changes - within several hours - are compensated by thermal inertia of kiln brickwork and no change in temperature can be registered. Longer changes - one day or more - cause the drift of the kiln to change the firing curve. In such a case, the input of the kiln must compensate the change in calorific value. In this example, the gas quality declined which was reflected by increased consumption (see Table 1).

Heat balance

The flue loss is considerably high (39.2% of the input) due to relatively high temperature and great volume of combustion products. The possibilities of its reduction are presented in the part of "Recommendations".

The loss by cooling air (17.72%) corresponds to that of other similar kilns. This hot air is utilized in driers of pressed products.

The brickwork of the cooling zone is intensively cooled by a vertical duct from which the hot air escapes to the ambient. This system increases the loss through brickwork and limits the utilization of hot air in a technological process.

The loss by accumulated heat in fired tiles and in kiln cars (4.5% can be partly reduced by lowering the outlet temperature.

The rest of the input (38.59%) is spent on the losses on chemo-physical changes in the fired material (technological loss), losses through lining, by leakage, to foundations, etc.

The specific consumption - 4 456 kJ kg^{-1} - exceeds the projected value - 3 720 kJ kg^{-1} - by 19.8%. It is caused partly by lower actual output than projected, partly by the adjustment of the kiln.

6. Recommendations

Firing conditions

a) To improve the temperature distribution in the cross-section of the preheating zone, it is necessary to increase the heat transfer from the kiln atmosphere to tiles, especially in the lower part of the kiln. This can be reached by closing several outlets to stack draught in the upper level and opening some of them in the lower level. Finally, about 20% of openings in the upper level and 35 - 40% in the lower level should be opened.

b) The high rapidity of cooling immediately after the firing zone can be reached by the adjustment of cooling fans to higher output.

c) To slow down the temperature decline from 600 to 500°C by complete closing of the cooling system in corresponding part of the kiln.

Pressure conditions

Pressure conditions will be improved by measures para a) and b) in the recommendations on firing conditions.

Heat balance

a) A partial closing of stack draught outlets will lower the amount of combustion gases and their temperature in the stack draught and thus the flue loss as well as the penetration of cold air into the preheating zone will be reduced.

b) A higher output of cooling fans will partly lower the overpressure in the firing zone and the penetration of the kiln atmosphere into the inspection tunnel will be reduced.

c) To improve the cooling in the last part of the kiln, it is necessary to increase the output of exit air lock. Lower temperature of tiles and kiln cars leaving the kiln will lower the loss of accumulated heat.

d) The part of heated air from the cooling zone obtained by the increased output of cooling fans should be used in the entrance air lock for preheating tiles.

The principle to be strictly observed during the kiln adjustment: Only one change should be realized and only after the response and when the new stabilized operation of the kiln is reached a new change can be accomplished. Thus the effect of each change can be registered.

Table 1 Consumption of town gas

Day of measurement	Consumption /m^3/	$m^3\ h^{-1}$	% of average value
1	13 571	565.5	97.5
2	13 795	574.8	99.1
3	13 962	581.8	100.3
4	14 174	590.6	101.8
5	14 117	588.2	101.4

The average consumption during the time of measurement:

580.2 $m^3\ h^{-1}$

Table 2 Average composition of town gas

Component	%
H_2	50.30
CO	14.90
CH_4	21.11
C_nH_m	0.59
CO_2	10.88
N_2	2.22

This composition corresponds to the calorific value:

1 4 184 kJ m^{-3}

Table 3 Gas Wobbe's number fluctuation

Day	Time	% of average value
1	6.oo	102.4
	12.oo	102.3
	18.oo	101.9
	24.oo	102.8
2	6.oo	101.3
	12.oo	100.5
	18.oo	100.7
	24.oo	100.9
3	6.oo	99.9
	12.oo	100.1
	18.oo	99.6
	24.oo	99.4
4	6.oo	99.0
	12.oo	98.1
	18.oo	97.8
	24.oo	98.1
5	6.oo	98.4
	12.oo	99.8
	18.oo	98.3
	24.oo	98.8

Table 4 Pressure conditions, CO_2 and O_2 concentrations

Section No.	Pressure /Pa/	CO_2 /%/	O_2 /%/
5	- 20.3	3.3	17.o
10	- 17.2	5.1	11.8
15	- 12.5	5.8	10.6
20	- 2.4	7.8	7.2
25	8.0	9.2	4.8
29	11.1	10.5	3.2
33	11.2	12.1	0.4
36	11.4	12.5	0.1
39	10.9	12.9	0.0
42	9.9	11.3	1.5
45	8.6	9.7	4.8
49	6.8	4.3	13.6
53	6.4	2.1	18.4
57	7.8	0.0	20.8

Table 5 Theoretical need of oxygen and amount of combustion products

Comp.	Volume /m^3/ in $1m^3$ of gas	Need of O_2 /m^3/	Combustion products /m^3/		
			CO_2	H_2O	N_2
H_2	0.503	0.2515	-	0.503	-
CO	0.149	0.0745	0.149	-	-
CH_4	0.211	0.4220	0.221	0.422	-
C_nH_m	0.006	0.0180	0.012	0.012	-
CO_2	0.109	-	0.109	-	-
N_2	0.022	-	-	-	0.022
Total	1.000	0.7660	0.481	0.937	0.022

II. BELT DRIER FOR WASHED KAOLIN

1. Technical Parameters

Type:	conveyor drier with forced circulation
Put into operation:	1974
Dried material:	washed kaolin
Drying medium:	hot air from heat exchanger
Output:	4 610 kg h^{-1} of dry substance
Inlet humidity:	28 % /+
Outlet humidity:	10 % /+
Specific consumption:	max. 4180 kJ kg^{-1} of evaporated water /+

/+ Projected values.

Heat exchanger:

Heat input:	2 585 kW
Heat useful output:	2 020 kW
Amount of heated air:	5.83 m^3 s^{-1}
Air outlet temperature:	max. 330°C, permanently 280°C

Fuel:

Fuel oil "S"	42 300 kJ kg^{-1}
Critical air consumption:	11 m^3 kg^{-1}
Dry combustion products:	10.31 m^3 kg^{-1}
Wet combustion products:	11.65 m^3 kg^{-1}
CO_2 max. :	15.6 %

The measurement was conducted under stable conditions, the drier operated without interruptions.

2. Objective of Measurement

The drier operated with a higher specific consumption than projected. Therefore, the recommendations were focused on the drying process improvement and energy conservation. The measurement proper determined the drying process economy and specific heat consumption.

3. Diagnostic Method and Applied Apparatuses

Oil consumption

An installed operation meter was applied for the determination of oil consumption.

Power output of driers

The technological line does not include weighing the processed material. Therefore, the calculation was based on the mass and number of filterpressed kaolin cakes. An average mass of dried cakes - 67.49 kg was taken into account. Humidities of the taken samples were determined in a laboratory. The samples were taken after 2-hour period. The temperature and moisture content of the drying medium were measured by a probe in the level of the surface of kaolin layer on the belt. The probe was sent together with dried kaolin through the drier and data were recorded continually by a recorder. The air flow velocity was measured by anemometers and by a Pitot's tube with micromanometers. Combustion products of the heat exchanger were analyzed by CO_2 and O_2 analyzers.

4. Testing Results

Temperature and relative moisture content of the drying medium on the level of dried material are presented in Table 6, graphically in Figure 7 together with the scheme of the drier. Table 7 presents the review of the following values:

- output - measured by the mass of moist kaolin at the entry of the drier
- fuel oil consumption
- relative moisture content of kaolin samples taken at the entry and exit of the drier
- temperature of kaolin samples
- CO_2 and O_2 concentrations in combustion products of the heat exchanger
- temperature of combustion products
- temperature of exhausted air from the drier (two exhausts)
- quantity of exhausted air (recalculated normal conditions)
- flow rate of primary air for the burner of the heat exchanger

Survey of selected parameters of the drier calculated from the measured values is presented in Table 8.

Example of calculations

Mass of dry matter:

$$M_{dm} = M_{ml} \times \left(1 - \frac{W_1}{100}\right) = 9.42 \times \left(1 - \frac{30.9}{100}\right) = 6.51 \text{ t h}^{-1}$$

M_{ml} - mass of entering material

W_1 - entry moisture content

Mass of evaporated water:

$$M_{we} = M_{ml} \times \frac{W_1 - W_2}{100 - W_2} = 9.42 \times \frac{30.9 - 13.7}{100 - 13.7} = 1.88 \text{ t h}^{-1}$$

W_2 - exit moisture content

Mass of residual water:

$$M_{wr} = M_{ml} - M_{dm} - M_{we} = 9.42 - 6.51 - 1.88 = 1.03 \text{ t h}^{-1}$$

Volume of dry air in exhaust:

$$V_{da} = V_{ma} - V_v = 7.14 - \frac{1880}{3600} \times \frac{22.4}{18} = 6.49 \text{ m}^3 \text{ s}^{-1}$$

V_{ma} - volume of moist air

V_v - volume of water vapour

Air for burner:

$$V_a = K \times S \times \bar{V}_a \times \frac{273}{273+t} \times \frac{p_b}{p_n} = 0.95 \times 0.108 \times 8.91 \times$$

$$\times \frac{273}{293} \times \frac{98.6}{101.3} = 0.829 \text{ m}^3 \text{ s}^{-1}$$

S - surface of the sucking opening

$\bar{V}_a$ - average velocity of air flow

t - temperature of air

p_b - barometric pressure

p_n - normal barometric pressure

K - correction coefficient for switching off the thermo-regulation

Excess air coefficient:

$$n = \frac{\% \text{ CO}_2 \text{ max.}}{\% \text{ CO}_2} = \frac{15.6}{11.1} = 1.41$$

Quantity of combustion products:

$$V_m = \frac{M_o}{3600} \times / V_{mt} + V_{at} \times (n-1) / = \frac{190.7}{3600} \times /11.65 + 11 \times$$

$$\times (1.41-1) / = 0.856 \text{ m}^3 \text{ s}^{-1}$$

M_o - consumption of oil (kg h^{-1})

V_{mt} - theoretical volume of moist combustion products (m^3 kg^{-1})

V_{at} - theoretical volume of air (m^3 kg^{-1})

Heat balance

Heat input by burning oil:

$$Q_o = H_o \times M_o \times \frac{1}{3600} = 42\ 300 \times \frac{190.7}{3\ 600} = 2\ 241 \text{ kW}$$

H_o - heating value of oil (kJ kg^{-1})

M_o - consumption of oil

Heat output for evaporation of water:

Heat necessary for evaporation of 1 kg of water:

q_{we} = 2 638 kJ

Heat output necessary for water evaporation:

$$Q_{we} = M_{we} \times q_{we} \times \frac{1}{3600} = 1880 \times \frac{2\ 638}{3\ 600} = 1\ 378 \text{ kW}$$

Flue loss

$$Q_{cp} = c_{cp} \times V_{cp} \times (t_{cp} - 20) = 1.425 \times 0.856 \times 268 = 327 \text{ kW}$$

c_{cp} - specific heat of combustion products (kJ m^{-3} K^{-1})

V_{cp} - volume of combustion products (m^3 s^{-1})

t_{cp} - temperature of combustion products (^oC)

Loss by exhausted air:

Exhaust No. 1

$$Q_{a1} = c_a \times V_{a1} \times (t_a - 20) = 1.318 \times 3.62 \times 40.2 = 192 \text{ kW}$$

Exhaust No. 2

Q_{a2} = 194 kW

Total:

$$Q_a = Q_{a1} + Q_{a2} = 386 \text{ kW}$$

c_a - specific heat of air (kJ m^{-3} K^{-1})

t_a - temperature of exhausted air (^oC)

Heat loss by accumulated heat:

By heat accumulated in dry matter:

$$Q_d = \frac{M_{dm}}{3600} \times c_m \times (t_{ex} - 20) = \frac{6 \times 510}{3600} \times 0.87 \times 7.6 = 12 \text{ kW}$$

c_m - specific heat of dry matter (kJ kg^{-1} K^{-1})

t_{ex} - exit temperature of kaolin

By residual water:

$$Q_{wr} = \frac{M_{wr}}{3600} \times c_w \times (t_{ex} - 20) = \frac{1030}{3600} \times 4.187 \times 7.6 = 9 \text{ kW}$$

c_w - specific heat of water

Review of heat balance

	kW	%
Heat input by burning oil	2 241	100
Heat output for evaporation of water	1 378	61.49
Flue loss	327	14.59
Loss by exhausted air	192	8.57
Loss by accumulated heat	21	0.94
Other losses (radiation, leakage, etc.)	323	14.41

The heat balance is expressed graphically in Figure 8.

Specific consumption (kJ per 1 kg evaporated water) 4 291 kJ kg^{-1}

5. Evaluation of Testing Results

Drying conditions

They are presented in Figure 1. The relative moisture content varies from 15 to 40% along the length of the active drying zone while the temperature attains about 90°C. This temperature differs considerably in comparison with the operation measurement by permanently installed thermometers which measure the temperature about 40 cm above the kaolin layer.

Operation parameters

The output of the drier is higher by 41% than the designed (see Table 3). This is the main reason why the required outlet humidity of kaolin (10% of water content) is not achieved. Also the decisive influence of inlet humidity at the entry into the noodle making machine is evident. With the inlet humidity up to 30.5%, short noodles showing a disturbed surface are produced. These noodles have a considerably larger surface for water evaporation and the belt of the drier is covered evenly. The relative humidity of exhausted air from the drier is relatively low (48%). It means that the parameters of the drying medium (temperature, relative humidity and flow velocity) are not optimum for the required output. Also the application of a perforated sheet for the conveyor belt does not enable optimum air flow through the layer of kaolin. The wire-woven belt is more advantageous from the point of view of air permeability. The overloading of equipment affects also evidently the quality of drying. The average output during six months preceding the measurements was 20% above the projected value.

Heat balance

In the heat balance, the useful heat for water evaporation represents more than 61%. The flue loss (14.59%) is lower than projected (22%). This favourable state is achieved by the optimum setting of firing conditions. The loss by exhausted air from the drier is low (8.57%) due to the relatively low temperature of exhausted air. Nevertheless, it can be lowered by a better utilization of drying medium.

The heat balance obtained by the diagnostic measurements is relatively favourable due to the uniform operation of the drier during testing. The frequent interruptions in its operation deteriorate the production economy.

Specific consumption

The specific consumption 4 291 kJ kg^{-1} obtained by measurements is only higher by 2.7% than projected. It is caused partly by the above-mentioned optimum operation conditions during testing, partly by drying to higher final relative humidity than projected. The specific heat consumption is in the uninterrupted operation only the function of dosing and inlet humidity of the dried material.

6. Recommendations and Expected Contributions

a) The supply of hot air to the drying space should be changed to bring the hot air as close as possible to circulation fans. By taking this measure, the temperature of the drying medium will be increased by approximately $10^{o}C$ and drying efficiency will also be higher.

b) All interruptions in operation should be limited as much as possible, especially by regularly feeding kaolin into the drier to avoid the operation of empty drier.

c) Recorders should be installed to record outlet temperatures of the drying medium. In this way, each halt of the belt and the duration of standstill would be reliably registered.

d) The inlet humidity of inputs of the drier should be lower than 30.5%. To meet this requirement, filterpresses should be adjusted accordingly.

e) The outlet temperature of combustion products over $280^{o}C$ makes possible to apply an additional heat exchanger to utilize this waste heat. The application of this heat for drying would save up to 20 tonnes of heating oil per year.

Table 6 Temperature and relative moisture content of drying medium

Section	Operation measurement /°C/	Temperature /°C/	Relative moisture content /%/
2		52	50.5
4	84	74	26.2
6		77	22.3
8	88	79	20.8
10		84	19.7
12		92	17.3
14	121	90	18.0
16		91	18.1
18		92	17.5
20	105	93	16.4
22		92	16.0
24		90	14.3
26	87	76	25.2
28		49	44.1
30		-	-

Table 7 Review of measured values

Time /h/	Output /t/	Oil consumption /kg/	Moisture content /%/		Temperature of material /°C/		Combustion products /%/		Temperature of combustion products /°C/
			entry	exit	entry	exit	CO_2	O_2	
7.oo			33.2	13.5	18.6	26.2			
8.oo							11.1	5.o	288
9.oo			30.4	15.2					
10.oo									
11.oo			30.0	12.2			11.3	4.9	285
12.oo					19.o	28.6			
13.oo			30.6	12.1					
14.oo							11.0	5.0	291
15.oo			30.8	14.2					
16.oo									
17.oo	94.241	1907.4	30.5	14.9	18.8	28.0	10.9	5.4	289
ø	9.424 $t\ h^{-1}$	190.7 $kg\ h^{-1}$	30.9	13.7	18.8	27.6	11.1	5.1	288

Table 7 Review of measured values - continuation

Time /h/	Temperature of exhausted air /°C/ exhaust 1	exhaust 2	Quantity of exhausted air /m^3 s^{-1}/ exhaust 1	exhaust 2	Primary air flow rate /m s^{-1})
7.oo					8.85
8.oo	62	65	3.55	3.46	
9.oo					
10.oo	61	63			
11.oo					
12.oo	58	60	3.68	3.61	
13.oo					8.97
14.oo	59	58			
15.oo					
16.oo	61	63	3.63	3.48	
17.oo					
Ø	60.2	61.8	3.62	3.52	8.91

Table 8 Survey of selected parameters of the drier

Output - moist material	($t\ h^{-1}$)	9.42
dry matter	($t\ h^{-1}$)	6.51
Evaporated water	($t\ h^{-1}$)	1.88
Residual water	($t\ h^{-1}$)	1.03
Consumption of oil	($kg\ h^{-1}$)	190.7
Quantity of air for burner	($m^3\ s^{-1}$)	0.829
Excess air coefficient		1.41
Quantity of combustion products	($m^3\ s^{-1}$)	0.856
Quantity of medium in exhaust	($m^3\ s^{-1}$)	7.14
Quantity of dry air in exhaust	($m^3\ s^{-1}$)	6.49
Relative moisture content in exhaust	(%)	48

III. FINAL NOTE

The presented publication was elaborated by the UNIDO-Czechoslovakia Joint Programme for International Co-operation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries in Pilsen to show the ceramic manufacturers in the developing and least developed countries the potentiality of economizing the operation of heat consuming units in the silicate industries by means of diagnostic measurements. Positive results achieved by these measurements were palpable. Depending on the operating conditions of respective heat consuming units, their specific heat consumption can be reduced down by 5 to 70% after taking the recommended remedial measures. The mostly result in the reduction of reject occurrence, production intensification and better quality of outputs. According to the Czechoslovak experience of last years, the application of the specialized diagnostic units has proved to be the most effective method of performing the diagnostic measurements.

This paper gives two examples of the most frequent diagnostic analyses in ceramic industry - the diagnoses of a kiln and of a drier.

The UNIDO-Czechoslovakia Joint Programme in Pilsen is ready to mediate further assistance in the field of energy conservation to the developing and least developed countries (advisory missions of experts, application of the diagnostic mobile unit owned by the Research Institute for Ceramics, Refractories and Raw Materials in Pilsen, assistance in construction of diagnostic mobile units, etc.)

IV. REFERENCES

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Research Institute for Ceramics, Refractories and Raw Materials in Pilsen, Technical Reports on Diagnostic Measurements, 1980 - 1983

ANNEX

List of Figures

1 Measuring Kiln Car

2 Measurement of Firing Curves

3 Measurement of CO_2 and O_2 Concentrations

4 Firing Curves

5 Pressure Curve, CO_2 and O_2 Concentrations

6 Heat Balance of Kiln

7 Temperature and Relative Moisture Content of Drying Medium

8 Heat Balance of Drier

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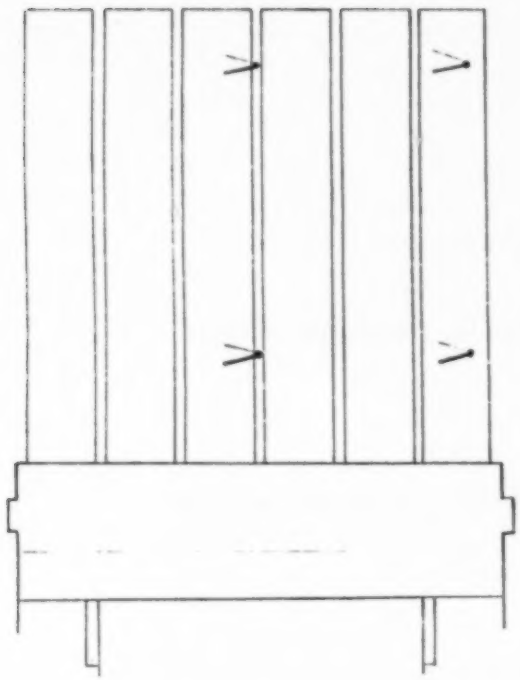
Figure 1: Measuring Kiln Car



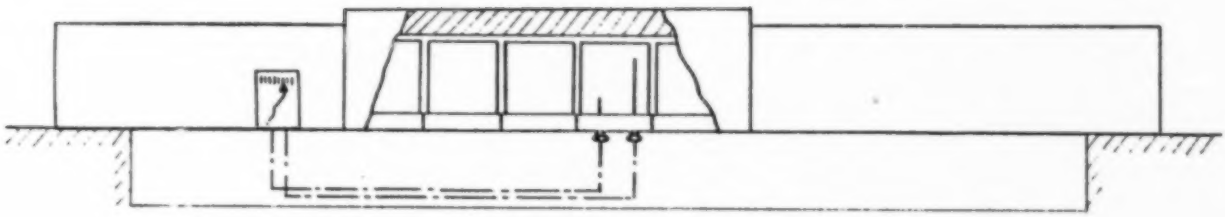


Figure 2: Measurement of Firing Curves

Figure 3: Measurement of CO_2 and O_2 Concentrations

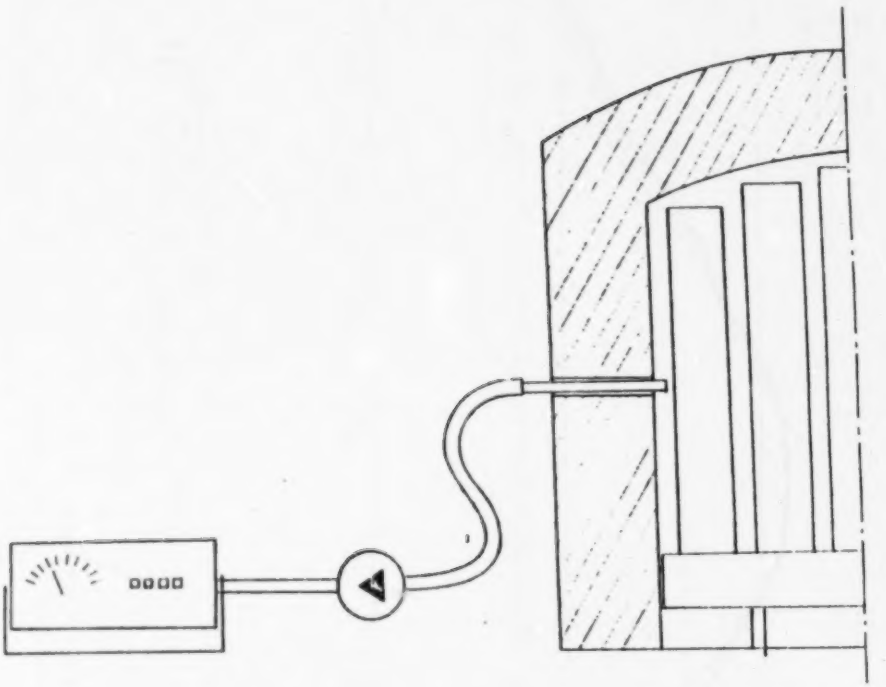


Figure 4: Firing Curves

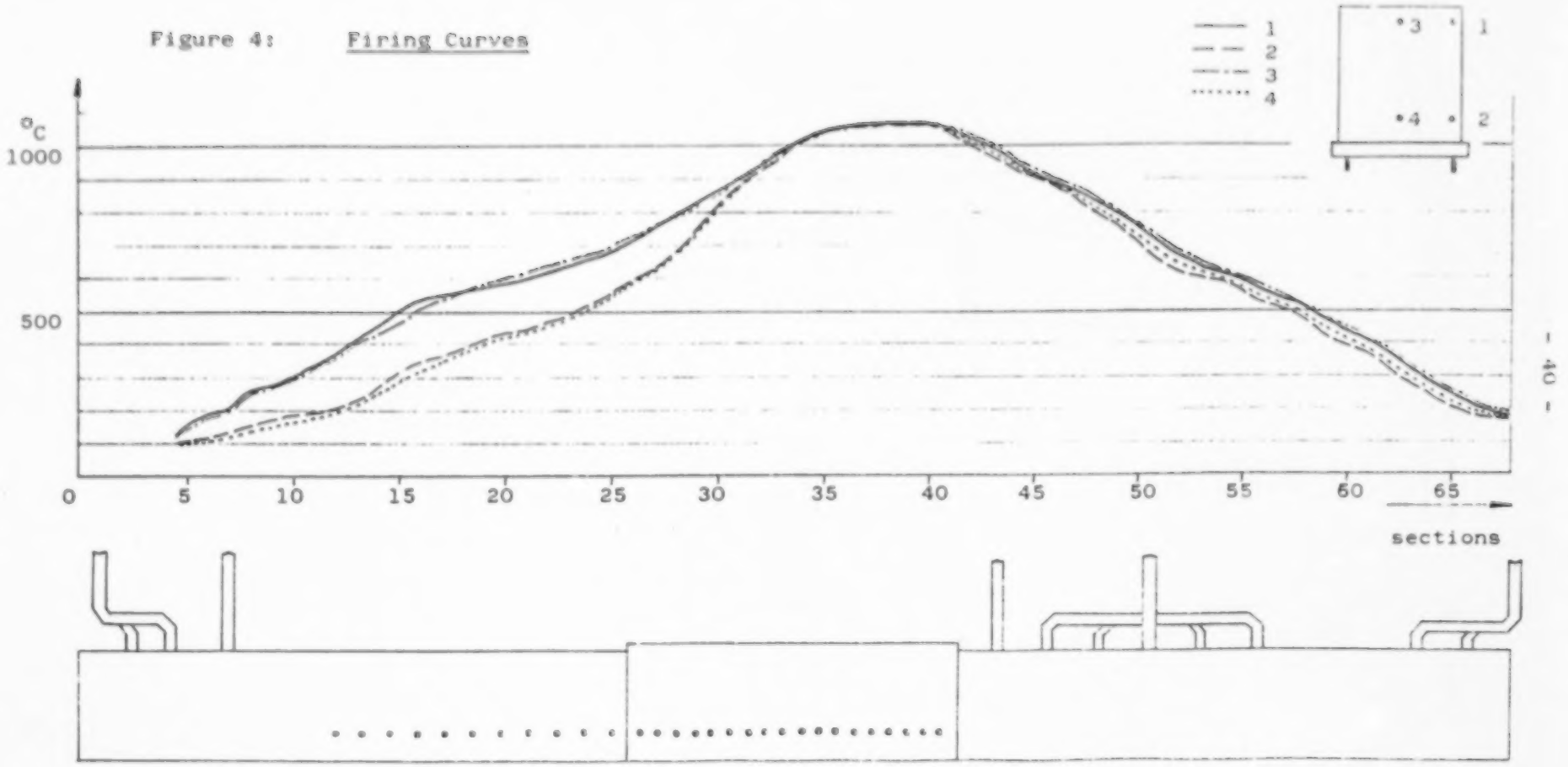


Figure 5: Pressure Curve , CO_2 and O_2 Concentrations

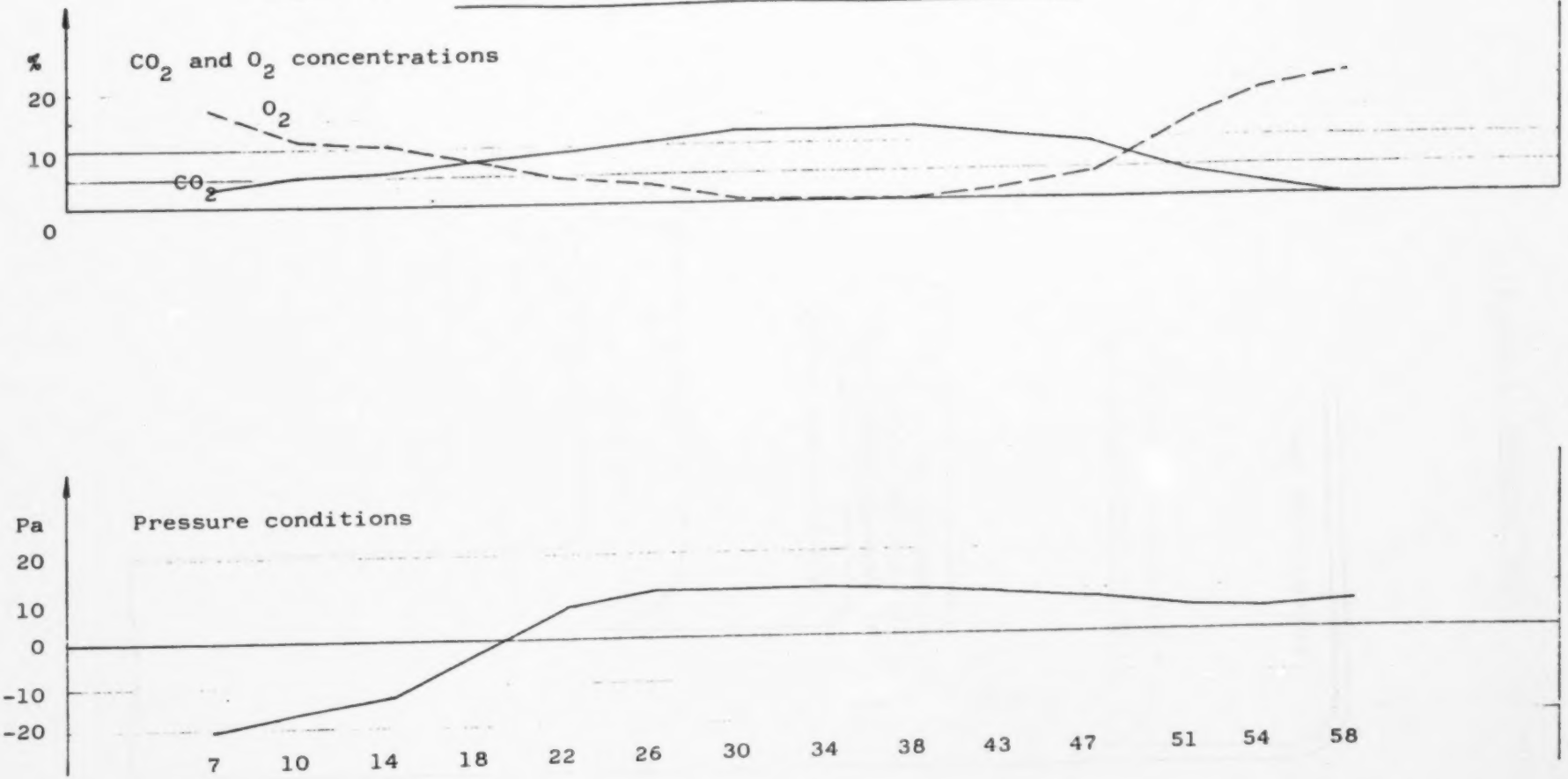
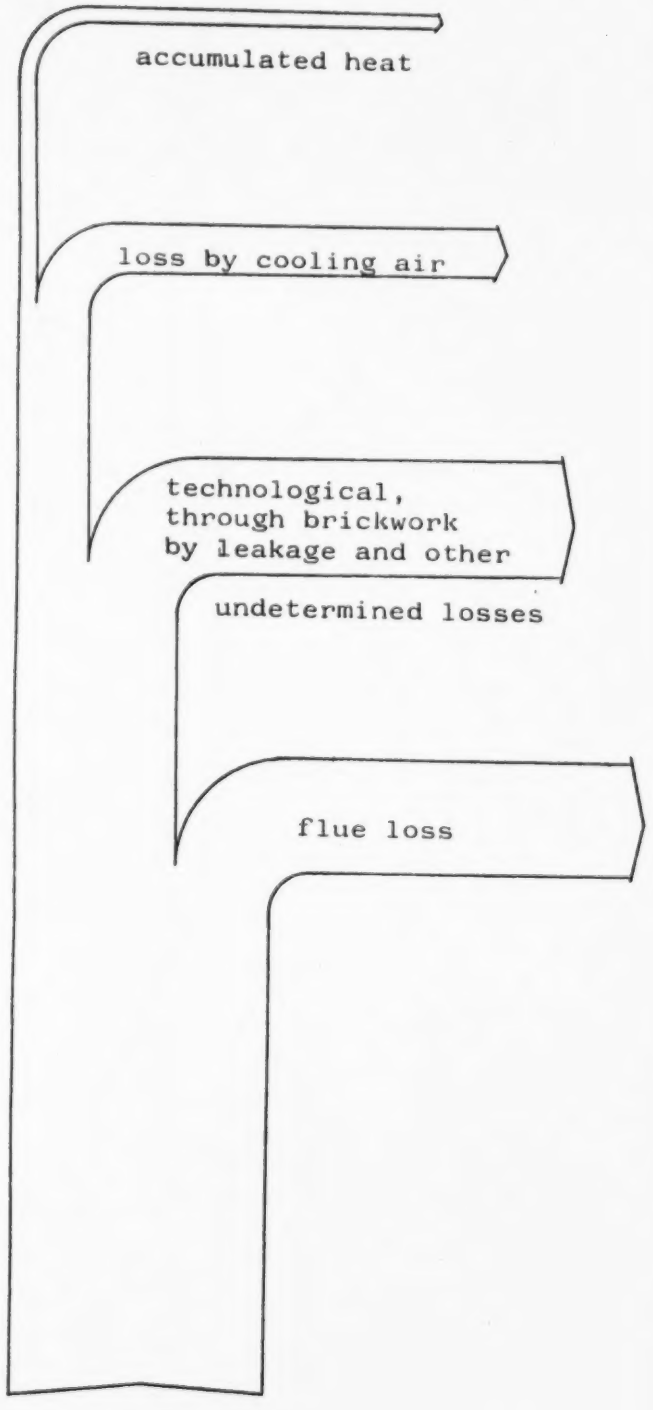


Figure 6: Heat Balance of the Kiln



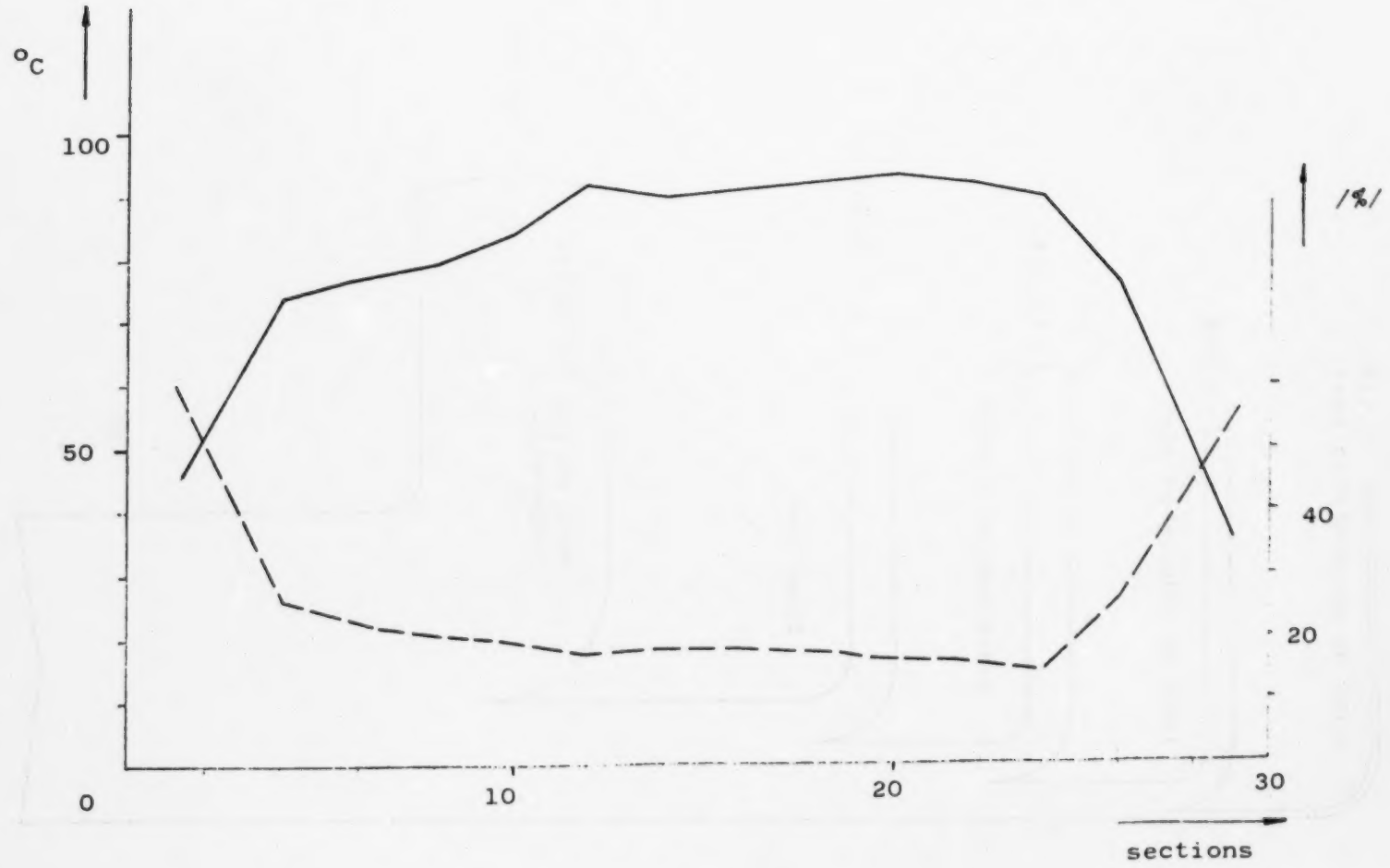


Figure 7: Temperature and Relative Moisture Content of Drying Medium

Figure 8: Heat Balance of the Drier